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**COMBAT RATION
ADVANCED MANUFACTURING
TECHNOLOGY DEMONSTRATION
(CRAMTD)**

"Powered Conveyor System for Tray Pack"
Short Term Project #1

FINAL REPORT
STP Results and Accomplishments (October 1989 to May 31, 1991)
Report No. CRAMTD STP #1 - FTR.1.0
CDRL Sequence A004
August 1991

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<p>In the plants of current Tray Pack producers, one operation that paces the rate of production is filling. If the ingredients include a low viscosity (liquid), movement of the filled can to the lidding position results in sloshing and product spilling onto the sealing surfaces. If the ingredients are of high viscosity (solid) they mound in the can and the lid will either slide material out of the container or non-uniformly flatten the mound contaminating the seam surfaces. Various reports indicate the need to have a powered conveyor with appropriate control features to integrate the filling, lidding, and sealing operations.</p>					
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19. The objective of the project was to design, develop, and fabricate a working prototype integrated powered conveyor to improve filling and sealing Tray Pack cans. A successful filling/sealing line will increase the rate of production and provide the flexibility to handle a variety of products for the civilian market in addition to combat rations.

The Tray Pack line, consisting of a Raque Piston Filler, Powered Conveyor, CheckWeigher, Mound Detector, Automatic Lid Dispenser and Yaguchi Seamer was designed and built as an electronically integrated system which was installed in the Rutgers CRAMTD Pilot Plant. The line was operated successfully in short runs up to production rates of 20 cans per minute. All transfers of the trays from conveyor to conveyor experienced no sloshing above the top of the can. However, at rates above 16 cans per minute with water and low viscosity liquids, some minor sloshing occurred in the Yaguchi Seamer. The Tray Pack line, as designed, can run at 16 cans per minute with all products regardless of viscosity and at 20 cans per minute with viscosities above 2600 cP. The rates require that the filling operation be capable of such speeds. For products currently requiring hand lay-up and complex filling of multiple components, such as Lasagna, overall production rates may be limited by the filling. Filling problems may be addressed in a separate project.

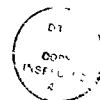
The Powered Conveyor, in addition to sloshing, addresses: (1) diverting without line stop trays with mounded product, off-spec weight or other tray inspection flaws, (2) augmented lidding automation to hold lid if no tray is present or stop line if out-of-lids, (3) programmable logic controller (PLC) use to allow CIM operation and a line fault condition display for operator trouble shooting, and (4) increased product settling through a vibrating section of conveyor.

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1.0 CRAMTD STP #1

1.1 Summary of STP #1 Progress

- STP #1 Technical and Cost Proposals were approved on August 29, 1989.
- A literature search (MITAC) of current Tray Pack technology (Appendix 4.3) was conducted by CRAMTD investigators and workshop discussions were held with Coalition members.
- State-of-the-art powered conveying equipment technology was reviewed with six vendors (potential subcontractors).
- Based on this technology review, a statement of work for a powered conveyor system including the capability to incorporate future automated ingredient feeding was prepared (Appendix 4.7).
- Requests for proposal were issued to six potential subcontractors (Appendix 4.8).
- A subcontract was awarded March 13, 1990 to Enterprise Electric, Inc., Plainfield, NJ, to design, develop and fabricate a prototype powered conveyor system for Tray Pack production.
- The Yaguchi Seamer and its Lid Dispenser, purchased by Rutgers were shipped from the seller, Custom Food Machinery, San Jose CA to Enterprise Electric, Plainfield, NJ.
- The standard relay electrical components of the Yaguchi Seamer were replaced with PLC electronics.
- Two mechanical modifications to the Seamer were made: addition of a variable speed drive on the Seamer and a clutch on the lid dispenser.
- The Tray-Pack line, consisting of the Raque Piston Filler, Powered Conveyor, Automatic Lid Dispenser and Yaguchi Seamer was operated successfully in short runs, up to production rates of 20 trays per minute. A final successful documentation/demonstration run was made on May 16, 1991 (Appendix 4.12).

1.2 Introduction and Background

STP #1 implementation was begun in early October 1989 based on the proposal submitted to the DLA on August 1, 1989 and revised on August 29, 1989 after detailed review with the DLA. The overall STP objective was to design, develop and fabricate a powered conveyor system for Tray Pack filling, checkweighing and sealing. The system was designed to accommodate future automated ingredient filling equipment and for integration into an advanced computer control system within the CRAMTD process automation Computer Integrated Manufacturing (CIM) strategy. The prototype line will run at higher production rates (up to 20-25 trays per minute) than are generally obtainable in current Tray Pack operations (4 to 8 trays per minute). Previous attempts to increase production rates have been unsuccessful due to severe ingredient "sloshing" (spillage) problems. In addition to control of "sloshing", the line will be able to fill and package various sized plastic trays provided a plastic tray sealing machine is installed in the future.

1.3 Results Summary

The line operates satisfactorily at production rates up to 20 trays per minute. All transfers of the trays from conveyor to conveyor experienced no sloshing above the top of the tray. However, at rates above 16 trays per minute, with water and low viscosity liquids, some minor sloshing occurred in two areas on the Yaguchi Seamer. The pusher arm that accelerates the tray

away from the conveyor lug to allow time for seaming and the stop in the seaming chamber both cause minor sloshing at rates higher than 16 trays per minute.

1.4 Conclusions

The tray pack line as designed can run at 16 trays per minute with all products regardless of the viscosity and at 20 trays per minute with viscosities above 2500 cP.

1.5 Recommendations

To prevent trays from sloshing on the Yaguchi Seamer at production rates above 16 trays per minute, a study should be made on the feasibility of modifying the pusher arm and stop in the seamer chamber to reduce the sudden acceleration/deceleration of the tray.

2.0 Program Management

This STP is a three phase work activity as illustrated on the Management Plan CRAMTD STP #1 "Powered Conveyor System, Time & Events and Milestones" (See Appendix 4.1). These phases cover the following:

Phase I Technology review that leads to detailed concepts and specifications of the new integrated powered conveyor system.

Phase II Fabrication and installation (including operability demonstration) of the new system at the CRAMTD pilot plant site by a subcontractor.

Phase III Testing, demonstrations and modification of the system as required.

Detailed objectives, statement of work and CRAMTD personnel responsibilities are described in the Technical and Cost Proposals for STP #1.

3.0 Short Term Project Activities

3.1 Technology Review & Preliminary Engineering (Phase I)

The attached drawing, (Appendix 4.2) illustrates the design concept of the Tray Pack Conveyor. This concept evolved from evaluating/reviewing current technology (MTIAC literature search, Appendix 4.3, and equipment vendors) and included considerations offered at Coalition workshop meetings (April 4-5, 1989). Automated filling ideas were included in these discussions.

The concept developed was to utilize an all electronic control system to achieve 1) greater operational flexibility and higher line speeds and 2) interaction with STP #4 "Design and Development of a CIM Architecture for Food Manufacturing".

A state-of-the-art Yaguchi Automatic Vacuum Seamer (Model YR-SV) with automatic lid dispensing was proposed. Conveyors, checkweigher and reject diverter were to be synchronized to the Yaguchi Seamer by a Fenner Digital Control system (called Electronic Line Shifting) (Appendix 4.4). This would provide for controlled uninterrupted transfer of the tray from filling through seaming, thereby minimizing product "sloshing". The Fenner System provided for changing of conveyor velocities and synchronizing transfer of trays from one conveyor to another and to a plastic tray sealer (if installed in the future).

The filling conveyor would have a series of flight bars to move the trays. A second set of flight bar would be provided to allow for adjustments to accommodate different size trays.

A Magnetic Flow Director (MFD) would be used to reject trays that are out of weight specifications. This reject mechanism uses horizontal sliding rods to smoothly direct the rejected trays aside without causing the ingredients to slosh. If, in the future, plastic trays are used on this line, the MFD will divert the trays to a plastic lid sealer and a "push off" rejector would be installed before this sealer to divert trays that are below specification weight (Appendix 4.5).

To assure that product has not mounded above the top of the unlidded tray, a fiber optic photoeye would be installed before the checkweigher and any trays with mounding would be rejected by the MFD. To reduce product mounding, a powered vibrating bed would be installed on the phasing conveyor before the checkweigher (Appendix 4.6). This would level the tray contents prior to the mounding fiber optic photoeye.

From information detailed in a previous Tray pack technical report ("Producibility Engineering and Planning for Tray Pack Foods", Natick/TR-88/007), conversations with Tray Pack producers and the United States distributor of Yaguchi seamers, the maximum sustained seaming rate for the model YR-SV machine was projected to be 20 to 25 half-tray steam table cans per minute. Based on this input, a production rate of 20 trays per minute was used in developing design criteria for fabrication of the conveyor system. Based on a review of current technology findings with the COTR, the following approach was agreed to:

- Ship seamer to selected subcontractor who will design and fabricate conveyor to Rutgers' specifications.
- Integrate system so that all equipment is synchronized thereby minimizing tray sloshing.
- Test and debug complete Tray Pack line through seamer at vendor's facility before shipping to the CRAMTD site.

Projected cost benefits derived from the Tray Pack Powered Conveyor System were developed in conjunction with an analysis of filling systems as an integral part of the base process under the Core Contract.

3.2 Design Specifications/Subcontract Considerations (Phase I)

A design specification for the overall powered conveyor system was prepared following the concepts described above. Six potential subcontractors were visited to evaluate their performance capabilities. Based on Rutgers' evaluation of the expertise of the potential subcontractors interviewed, it was concluded it would be more efficient (cost and design time expended) to have the successful subcontractor prepare the necessary assembly drawings than to procure the required manning for in house development. Requests for proposal to fabricate the powered conveyor in accordance with the specification statement of work were sent to the six potential subcontractors (Appendices 4.7, 4.8).

After review and evaluation of returned proposals, Enterprise Electric, Inc., Plainfield, NJ, was the recommended subcontractor for fabrication and installation of the conveyor system.

Full details of powered conveyor system specifications and subcontractor proposals were forwarded to the DLA for their review on December 20, 1989 in accordance with the CRAMTD contract. DLA approval and funding authorization was received on March 9, 1990. A subcontract was then awarded to Enterprise Electric to design, develop and fabricate the prototype conveyor system on March 13, 1990.

3.3 Fabrication/Assembling/Monitoring (Phase II)

CRAMTD personnel visited Enterprise Electric on a regular basis to review the fabrication/assembly of the conveyor system.

The Yaguchi Seamer and its Lid Dispenser, purchased by Rutgers, was dismantled and shipped from the seller, Custom Foods Machinery, San Jose, CA directly to Enterprise Electric, Plainfield, NJ. On arrival at Enterprise Electric, Central States Can reassembled the Seamer/Lid Dispenser and they were run to check all the machine components for satisfactory operation. This included sealing the lids onto the tray pack cans.

The Control Strategy Plan (Technical Working Paper (TWP)14) for the tray pack filling and sealing line was updated in accordance with the final process specifications for the CRAMTD pilot plant (Appendix 4.9).

The entire Powered Conveyor (Tray-Pack) Line was assembled by the subcontractor, Enterprise Electric. This included the conveyor sections: filling, spacing, phasing and reject conveyors along with the other line components: checkweigher, (Computa • Weigh II, Appendix 4.6) reject diverter (MFD Divider, Appendix 4.5) and Yaguchi seamer.

Enterprise Electric replaced the existing electrical components of the Yaguchi Seamer with PLC electronics to provide for future CIM architecture. The program printout and backup diskettes, panel wiring diagrams, input/output diagram and panel/enclosure layouts were provided by Enterprise Electric and are on file at CRAMTD.

3.4 Testing/Debugging/Modification (Phase II)

Two modifications to the Line were made: addition of a variable speed drive on the Seamer and a clutch on the lid dispenser.

The original design included a manually controlled drive speed. It was observed that the addition of a variable speed drive would enable the conveyor to be controlled electronically and that electronic control is more in keeping with the planned Level 2 computer controlled production. Therefore, a 5-HP Speedstar Plus variable frequency drive, with a Fenner M-Trim control, were installed on the Seamer. A clutch was required on the lid dispenser so that a lid is only dropped on those conveyor positions having trays. The modification consisted of installation of a Warner clutch, mechanical modifications to accommodate the clutch, electrical connection to the main control cabinet PLC controller, and provision of the necessary control logic.

Testing and debugging of the Tray Pack line was conducted to verify that the specification requirements were met and also that the modifications (addition of a variable speed drive and a clutch for the lid dispenser) performed as designed.

An acceptance test was conducted at Enterprise Electric's facility on October 17, 1990 and the unit approved for shipping to the CRAMTD Demonstration site (Appendix 4.10).

3.5 Install at CRAMTD Site (Phase II)

All documentation, including the operating manual (Appendix 4.11), drawings, software and equipment manuals were provided.

The Line was delivered to the CRAMTD Site on October 24, 1990.

3.6 Testing/Modifying & Demonstration Runs (Phase III)

Test runs were conducted to establish performance of the Powered Conveyor/Seamer (Tray Pack) Line in the areas of: line mechanical operation, seam quality, and product sloshing.

Approximately 100 trays were filled and processed during documentation/demonstration runs (Appendix 4.12) observed by representatives from DLA and NRDEC. The line had one shutdown due to an "Out of Lids" condition. When trays with cubes above the rim were introduced the mounded trays were diverted while acceptable trays continued to the seamer. Several underfilled and overfilled trays were run to demonstrate the checkweigher function resulting in trays below 104 ounces and above 110 ounces being correctly rejected.

Eight cans from the above documentation/demonstration runs were pulled for seam inspection/evaluation. The runs represented included those at 10, 16, and 20 trays/minute. All seams were within the Central State Can Company double seam guidelines (Appendix 4.13).

The extent of product sloshing during processing on the Powered Conveyor/Seamer (Tray Pack) Line was observed during test runs, video-taped for detailed examination and quantified through weight loss measurement. The results of a series of test runs on April 24-25 which included over 200 trays found that in the conveyor section, sloshing is limited and occurs only when water is used (even then there is no sloshing out of the tray). A potential problem may arise at the seamer section operating at 16 tray/minute or higher speed for tray cans containing liquids with viscosities less than 1000 cp (Appendix 4.14). Since sloshing was observed at 16 trays per minute with low viscosity liquid fills, a follow-up test was made to measure the amount of sloshing (Appendix 4.15). The measured loss was within the accuracy of filling methods (less than 3% of the liquid fill) and will easily meet product specifications for net weight. Inspection of sealed cans showed no leaks and complete seams (no defects).

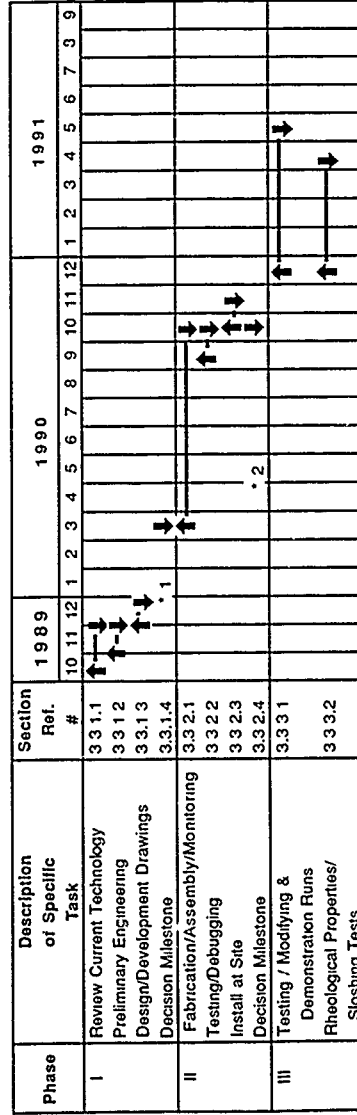
Approximately 1000 trays have been processed on the Powered Conveyor/Seamer (Tray Pack) Line. Most of these have been in conjunction with Short Term Project #3, "Generic Statistical Process Control". Since becoming operational, the Line is operated a minimum of once each week. The Tray Pack Line will continue to be available for demonstration runs for Coalition Members, Military, and other industry representatives. It will continue to be used to conduct tests under STP #3.

4.0 Appendix

- 4.1 Projected Time & Events and Milestones
- 4.2 Tray Pack Conveyor Drawing
- 4.3 Literature Search
- 4.4 Fenner Digital Control
- 4.5 MFD Divider
- 4.6 HI-Speed Checkweigher
- 4.7 Statement of Work
- 4.8 Requests for Proposal
- 4.9 Technical Working Paper (TWP)14
- 4.10 Acceptance Test
- 4.11 Operating Manual
- 4.12 Documentation Demonstration Run
- 4.13 Seam Inspection of Cans-Memo 5/23/91
- 4.14 Tray Pack Can Sloshing Report
- 4.15 Investigation of Slosh

Appendix/ 4.1

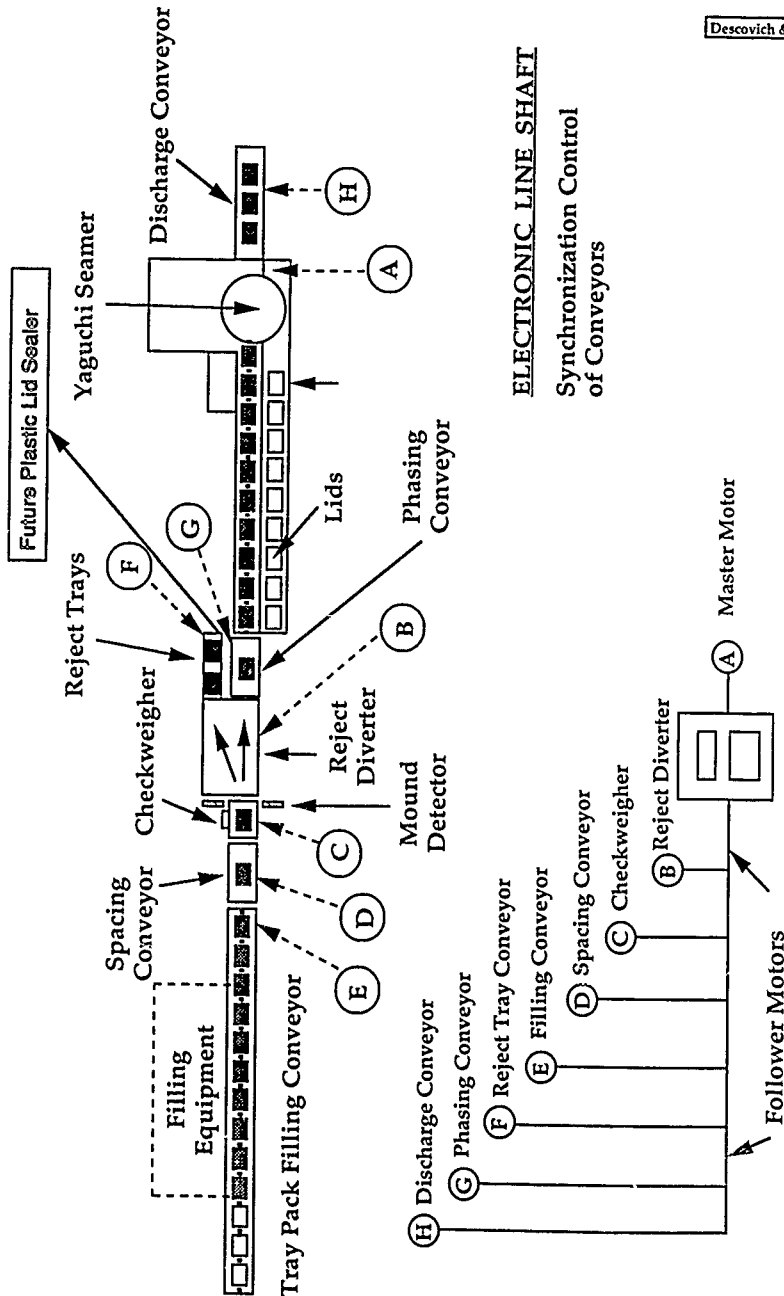
Fig 1 - CRAMTD Short Term Project #1
Powered Conveyor
Projected Time & Events and Milestones



*1 = Technical review/Order conveyor
*2 = Accept conveyor

Legend: ↑ = start ↓ = completed □ = projected start □ = projected completion □ = delay

Descovich & Yam

STP#1 -- TRAY PACK CONVEYOR

Fenner M-Track

FIGURE 1 - MASTER/FOLLOWER MOTOR CONFIGURATION FOR TRAY PACK LINE

I N T E R O F F I C E M E M O R A N D U M

CRAMTD

July 17, 1990

TO: Files
FROM: A. Sigethy *sig*
RE: Literature Search - Combat Rations

A search for information relative to combat rations (retortable pouches and half steam table cans) was completed via MTIAC

A total of 57 references were identified. Of these, the following 3 (abstracts below) were pertinent to the powered conveyor system for Tray Pack production:

1) "Cost Driver Analysis for Tray Pack Foods", AD# A194668, Mar 1988.

Abstract: Tray Pack foods are one of the primary ration sources for the new Army combat field feeding system. Cost and quality control are necessary for all facets of the Tray Pack manufacturing process: from the distribution and warehousing of raw materials, preparation and assembly of menu items, closing and sterilization of the product containers, to the eventual packaging and shipping of the completed assemblies. The purpose of this study is to identify and quantify the major cost factors of the manufacturing process of Tray Pack foods. This project report identifies and quantifies the major cost factors of the manufacturing process of Tray Pack foods. The purpose of this project is to conduct a cost driver analysis of the manufacturing process so that a system-wide data base of the production, manufacturing, and distribution costs of Tray Packs would enable researchers to pinpoint problem areas. The goal of the analysis is to suggest possible cost saving to reduce and control overall costs of manufacturing Tray Packs.

2) "Producibility Engineering and Planning for Tray Pack Foods", AD# 190209, Sep 1987.

Abstract: The primary objective of this project was to carry out a producibility, engineering, and planning (PEP) analysis of production systems for the manufacture of Tray Pack foods for military field feeding use. Existing production capacities of Tray Pack foods, current manufacturing processes, and automated equipment and technologies have been examined in this PEP analysis in order to evaluate the ways and means of

meeting Tray Pack demand. The report documents the on-site visits, observations, and subsequent analysis of the PEP teams' visit to six producers of Tray Pack foods. In essence, the report documents a number of deficiencies in the system for manufacturing technologies and operations currently employed by producers. Problems, issues and recommendations center on engineering and planning, engineering design, and engineering control of Tray Pack foods. It was concluded that unless action is taken to improve manufacturing technologies and operations, desired production volumes for Tray Packs will not likely be achieved.

3) "Tray Pack Prototype Plant Design", AD# A180296, Jun 1986.

Abstract: This project report describes the engineering design of a prototype production facility for the automated manufacture and assembly of Tray Pack foods for Army field feeding use. The plant was designed to produce 44 menu items for a total production rate of 17 million Tray Packs/year on automated assembly lines designed to operate at 20 cpm. The report describes the schematic engineering design of the entire facility which includes the following activity areas: I. Receiving Warehouse, II. Preparation Area, III. Filling Lines, IV. Sterilization Area, V. Packaging and Labelling Area, VI. Shipping Warehouse, and VII. Administrative/Staffing Areas. The overall size of the plant is 210,081 square feet. A cost analysis of the plant, personnel and equipment together with appendices describing equipment suppliers, specialized automation equipment, and related software products is also included.

Documentation of the complete search is contained in the CRAMTD files. Specific titles are listed in Attachment 1.

Literature Search
 Combat Rations - Horizontal Form/Fill/Seal Machine

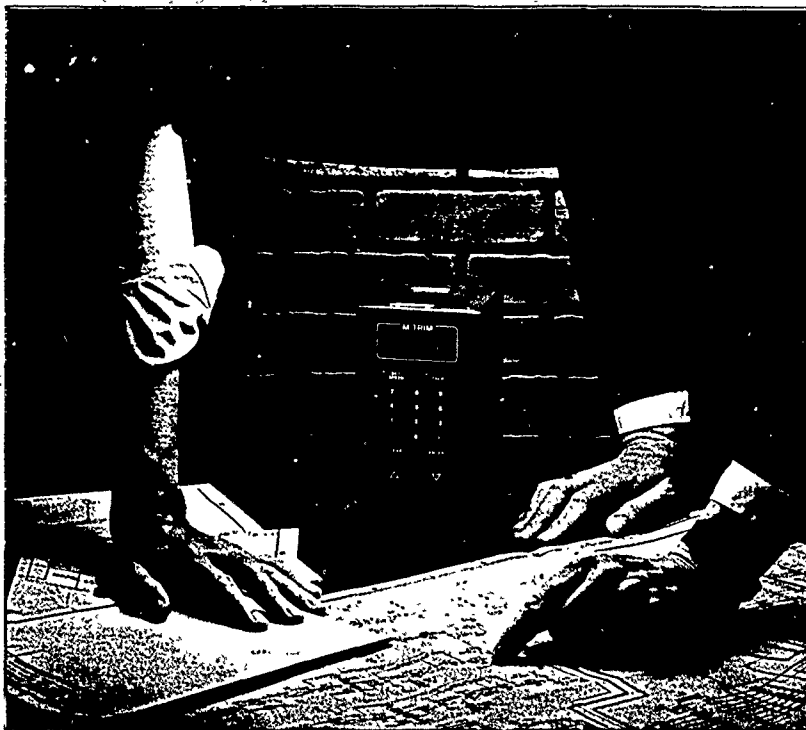
MTIAC

<u>AD Number</u>	<u>Title</u>	<u>Date</u>
D440506	Coextrusion Blow Molding of Barrier Structures for Rigid Containers with Polycarbonate Resins.	May, 1986
D439233	High-Barrier Packaging - What are the Options.	Mar, 1985
D438630	Properties of a New Biaxially Oriented Nylon 66 Film.	Apr 30, 1984
D438432	Permeability of Polymeric Membrane Lining Materials,	1984
D437664	FoodPlas 83/84	Jan 18, 1984
D437173	Physical Testing of Transparent Films in the Laboratory and its Relationship with Packaging Performance.	Sep 15, 1963
D437171	A Chromatographic Method for Measuring the Gas Permeability of Packages.	Sep 15, 1963
D437159	Evaluation of Package Performance.	Sep 15, 1963
D433849	Polypropylene Film.	Sep 11, 1960
D433154	A Practical Gas Permeation Test for Plastic Containers.	Mar 7, 1966
D432189	Macro-encapsulation of PCM.	Aug, 1978
D430578	Plastics Packaging in the Space Program.	Nov 19, 1963
D430577	Progress in Films, Laminations and Coatings.	Nov 19, 1963

D429837	Research and Development Associates Inc., Activities Report, V. 21, No. 1.	1969
D429836	Research and Development Associates Inc., Activities Report, V. 20, No. 1.	1968
D429835	Research and Development Associates Inc., Activities Report, V. 19, N.2.	Apr 11, 1967
D429822	Effective High Speed Gas Packaging.	Dec, 1961
D429818	Conventional Retorting and Flexibly Packaged Products.	Dec, 1961
D429817	Problems in Assuring Sterility in Thermally Preserved Flexibly Packaged Foods.	Dec, 1961
D429814	Quartermaster Food and Container Inst for the Armed Forces, Activities Report, V.13, No.4.	Dec, 1961
D428224	Stability of Tomato Pastes Packaged in Plastic Laminated Pouches.	Aug 19, 1979
D428212	Oxidized Polyethylene Flavor: Source, Measurement and Characterization in Food Packaging Systems.	Aug 19, 1979
D428211	The Direct Measurement of Respiration of Natural Cheese in Polymeric Film Package.	Aug 19, 1979
D426608	Package Integrity and Performance.	Nov 17, 1964
D426606	Convenience Foods.	Nov 17, 1964
D425406	Retort Pouch Earns 1978 IFT Food Technology Industrial Achievement Award.	Jun, 1978
D425365	Microbial Recontamination in Flexible Films.	1967
D425361	Conference on Food from the Sea.	1967

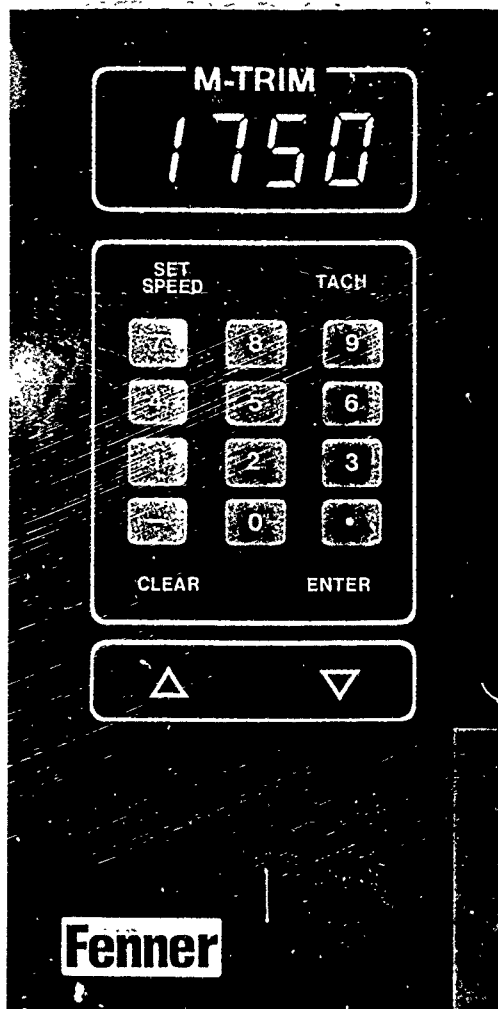
D424718	Approaches to Mechanical Sealing Problems.	Feb 2, 1976
D423926	Testing Procedures for Retortable Pouches.	-
D423925	Meeting on Retortable Pouches.	Jun 6, 1975
D423715	The Reliability of Flexible Packages.	1968
D423223	Retort (Processable) Pouches (II) Outline Specification for Retort Pouches, Polyester/Aluminum Foil/Polyolefin.	Feb, 1975
D423221	Integrity Aspects of Package Seals.	Feb 2, 1976
D423220	Approaches to Mechanical Sealing Problems.	Feb 2, 1976
D423219	Heat Seal Characteristics of Polyolefin Materials.	Feb 2, 1976
D423218	Ultrasonic Sealing of Thin Film Thermoplastics.	Feb 2, 1976
D423217	Laser Welding of Thin Plastic Sheets.	Feb 2, 1976
D423138	New Opportunities in Manufacturing Formed Containers Using the Scrapless Forming Process.	Jun 14, 1977
D422506	An Overview of the Retort Pouch in the U.S.	Feb, 1976
D422505	Performance and Integrity of Retort Pouch Seals.	Feb, 1976
D407098	Flexible Packages Now Withstand Heat-Processing Temperatures of Foods.	Mar, 1962
D405798	Resolving the Retort Pouch Ruckus.	Mar, 1975
B063877	Investigation of the Suitability of 6 Packing Tray Models with Respect to Long Range Storage and Transport.	Jun 15, 1981

A199696	Summary of Tray Pack Field Acceptance Tests and Results.	May, 1988
A196857	Studies of Tray Pack Coffee Cakes and Spice Cakes Adjusted to Water Activities of 0.86 to 0.93 and Inoculated with Clostridium Botulinum.	Jun, 1988
A194668	Cost Driver Analysis for Tray Pack Foods.	Mar, 1988
A191716	Bacterial Growth in Tray Pack Acidified Rice.	Jan 1, 1987
A190209	Producibility Engineering and Planning for Tray Pack Foods.	Sep 7, 1987
A189268	Meal Module, Tray Pack 36-Persons.	Aug 27, 1987
A180296	Tray Pack Prototype Plant Design.	Jun, 1986
A170398	An Evaluation of Foods Processed in Tray Pack versus Two Standard Food Service Containers. Part 2.	Feb, 1986
A167187	An Evaluation of Foods Processed in Tray Pack versus Two Standard Food Service Containers. Part 1. Sensory, Container and Bacteriological Tests.	Feb, 1986
A164595	Design and Production of Damage-Resistant Tray Pack Containers.	Jul, 1985
A160816	Tray Pack Improved Durability Packaging Rough Handling Test Results.	Mar, 1985
A148850	Cold weather 83 Evaluation of the Mobile Food Service Unit and Tray Packs.	Aug, 1984
A089359	Effects of Long-Term Storage on Quality of Processed Foods. I. Meal, Ready-to-Eat, Individual Ration Items Packed in Flexible Retortable Pouches.	Dec 28, 1978



**When you need
better speed control,
it pays to bring in
the best brain.**

The M-Trim Universal Digital Speed Control.



It's the smart choice for tough speed control jobs. The M-Trim is an easy-to-operate 1/2 DIN size instrument designed for stand-alone control of a single motor, or coordination of more complex multi-motor drive systems. Its advanced intelligence comes from a 16-bit microprocessor and sophisticated new internal software. The M-Trim will replace the speed pot in virtually any variable speed drive, providing digital control with improved precision and more flexible features for a wide range of applications.

Solve speed control problems with unparalleled precision.

The M-Trim provides closed-loop speed regulation with zero accumulative error (follower mode). The unit's 10 millisecond loop update creates a unique ability to stabilize cyclic load fluctuations, and makes M-Trim a reliable, low-cost alternative for servo motor control.



Sealed face panel provides an easy-to-use keypad, with programming functions behind a separate door to simplify day-to-day operation.

Advanced communications for factory automation.

The M-Trim combines a serial RS-422 communications port with direct-access programming to form a powerful link in your factory automation scheme. Addressable, two-way communications make M-Trim the smart choice for distributed control, providing interrogate, down-load and command functions. Direct access to control parameters simplifies interface design.

Telephone diagnostics assistance.

Users with a telephone modem can connect the M-Trim directly with the factory for immediate diagnostic and programming assistance. This creates a unique ability to simplify set-up and maintenance procedures in your drive system.

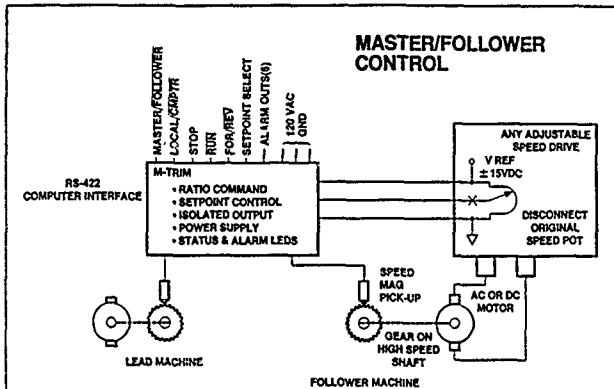
An integral keypad.

Fenner has replaced cumbersome thumbwheels and dip switches with a sealed keypad for very simple, flexible programming. Dedicated keys are provided for SET SPEED and TACH. Setpoints can be entered numerically or with SCROLL keys (2 units/sec). Programming functions are beneath a separate panel.

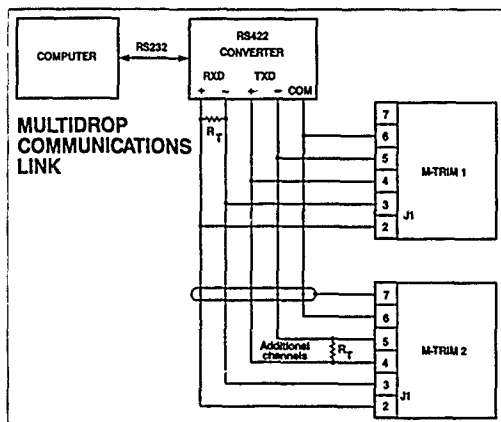
Universal advantages.

The M-Trim is a true universal speed controller. It provides precise digital control to virtually any AC, DC, Servo or Clutch drive, and will follow pulse-type speed sensors of all types.

The M-Trim offers five preset speeds or ratios to allow quick change of conditions. Direct, follower and computer supervised operating modes and four alarms for limit and deviation setpoints are available. Readouts are displayed in engineering units, with command and display easily scalable for different units or pulse rates from the front panel. A lock-out and setpoint limit are provided for security.



M-Trim provides a full range of advanced inputs and outputs for flexible speed control.



Typical 2 channel shown. Multidrop communications link can individually address up to 32 M-Trims.

Specifications:

Accuracy: Zero accumulative error—follower mode

Response:

- 1) 10 mil/Sec control loop time
- 2) Adjustable PID gains for stability.

Modes:

- 1) Absolute—Absolute command of output (ignore f b)
- 2) Direct—Operate from operator keypads
- 3) Follower—motor follows external reference at selected ratio
- 4) Remote—Computer commands mode and speed/ratio or selects local presets
- 5) Jog—Direct control with job preset speed.

Setpoints:

- 1) 2 presets for Direct mode
- 2) 2 presets for Follower mode.
- 3) 1 preset for Jog mode
- 4) Hi-lo limits for operator selected inputs.
- 5) Lock-outs restrict which setpoints operator can change.

Accel/Decel Ramps:

- 1) Separately adjust 0-6000 sec.
- 2) Setpoint "Hold" input permits external hold of ramp action
- 3) Ramp stop or fast stop selectable

Engineering Units:

- 1) Display and Setpoints separately scalable.
- 2) Simple set-up, input pulses per rev and eng units.
- 3) Decimal point selectable for both display or setpoint

Sensor Types:

- 1) Magnetic pick-up (2-wire variable reluctance)
- 2) Encoders or prox switches (3-wire, open collector w or w/o pullup, or current source—up to 12v source potential)
- 3) +12v dc (100 m.a) available to power sensors or external option cards

Inputs:

- 1) Feedback pulse train.
- 2) Reference pulse train.
- 3) Aux pulse train (2nd ref or f b or trm input).
- 4) Run/Stop (ramped)
- 5) E-Stop (fast stop).
- 6) Jog at jog speed.
- 7) Fwd/Reverse (inverts output polarity for most regen drives)
- 8) Primary/Secondary Mode—normally local/follower but could be 2 variations of the same mode
- 9) Open loop/closed loop mode.
- 10) Keypad/Remote—keypad or computer input mode (computer can always monitor).
- 11) Setpoint Hold—hold or pause command to accel/decel ramp.
- 12) Lock-out—restricts operator inputs on keypad face panel
- 13) Preset speed selects (2)—selects preset speeds (primary and secondary mode each have separate keypad or preset speeds for a total of 4 possible setpoints).

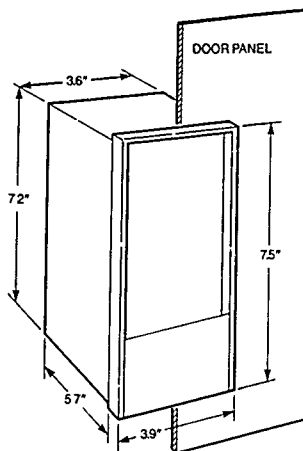
Outputs:

- (Open Collector, N.O. with flyback diodes 50vdc max external source)
- 1) Zero Speed—Low at any speed greater than 1 RPM
 - 2) Alarms—Low when alarm condition is present
 - a) Hi Alarm
 - b) Low Alarm
 - c) Deviation #1
 - d) Deviation #2
 - 3) Fwd/Rev—Low on Reverse (inverted output polarity)
 - 4) Reference Signal to Controlled Drive—Isolated, automatically ranges to required value for any drive (± 15 vdc max)

Computer Interface:

- 1) Serial RS422 (optional RS232)
- 2) Software addressable up to 32 channels
- 3) 4-wire twisted or shielded pair wiring.
- 4) Can monitor up to 50 operator selected or internally generated parameters for diagnostic purposes. Monitor function available full-time (whether control input from computer is enabled or not)
- 5) Mask-selects determine which parameters are computer vs. operator controlled.

Panel Requirements:

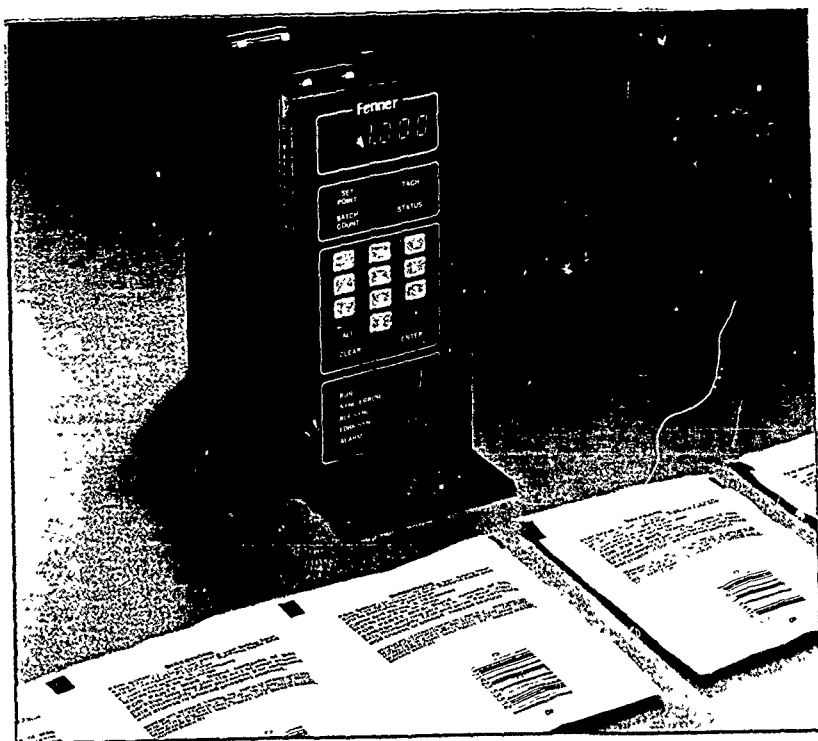


Fenner

Fenner Industrial Controls, Inc.
8900 Zachary Lane North, P.O. Box 9000
Maple Grove, MN 55369 USA
Telephone (612) 424-7800 Telex 29-0808

For more information, call TOLL FREE 1-800 FIC-4411 and ask for an applications engineer.

Form DS 382



The smart way to
synchronize your
production lines

Advanced communications for factory automation.

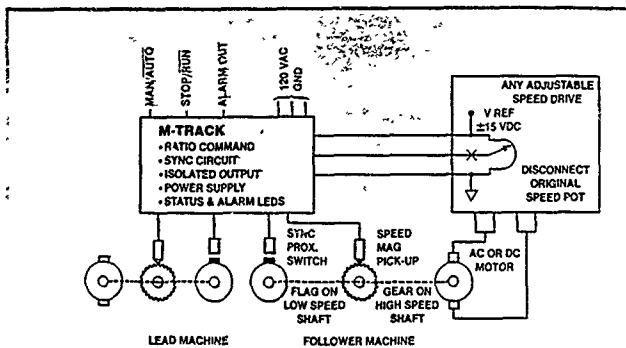
The M-Track combines a serial RS-422 communications port with direct-access programming to form a powerful link in your factory automation scheme. Addressable, two-way communications make M-Track the smart choice for distributed control, providing interrogate, download and command functions. Direct access to control parameters simplifies interface design.

Integral keypad.

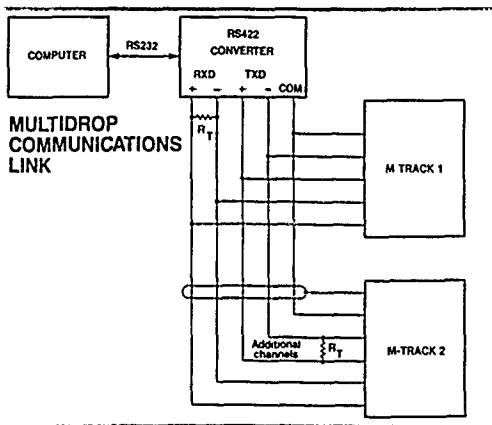
Fenner has replaced cumbersome thumbwheels and dip switches with a sealed keypad for very simple, flexible programming. Dedicated keys are provided for SET SPEED and TACH. Programming functions are beneath a separate panel.

M-Track advantages.

The M-Track offers five preset speeds or ratios to allow quick change of operating conditions. Direct, follower and computer supervised operating modes and five alarms for limit and deviation setpoints are available. Readouts are displayed in engineering units, with command and display easily scalable from the front panel for different units or pulse rates. A lock-out and setpoint limit are provided for security.



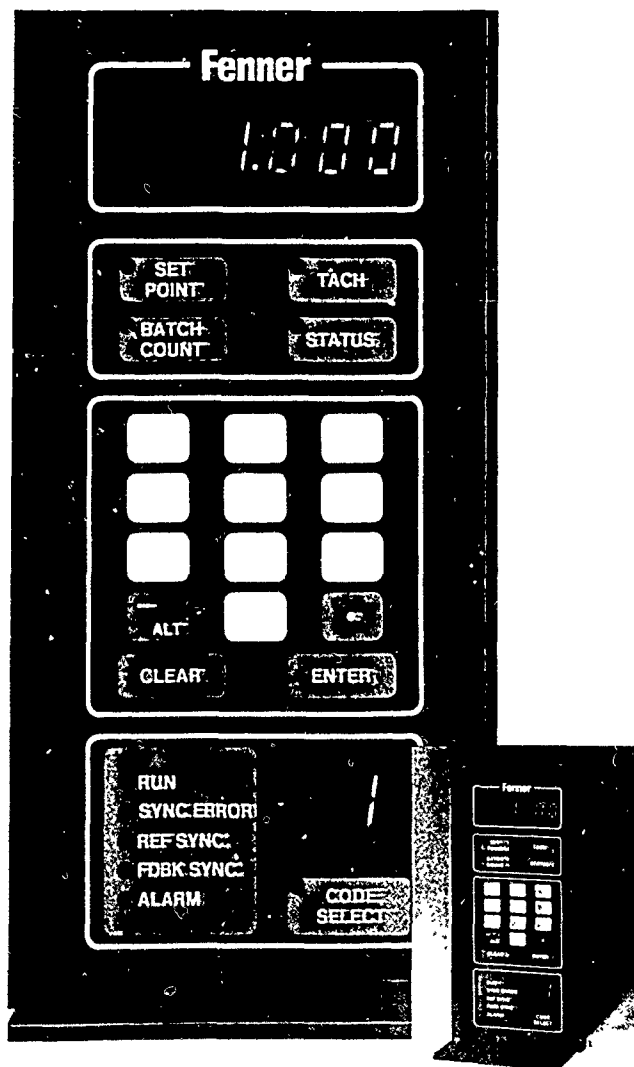
M-Track provides a full range of advanced inputs and outputs for flexible, simplified speed control.



Typical two channel shown. Multidrop communications link can individually address up to 32 M-Track units.

FENNER DIGITAL CONTROL

The M-Track Digital Synchronization Control.



The M-Track is a highly intelligent controller with self-learning capabilities that make set-up and programming simpler, easier and faster, and require significantly less operator intervention. It is capable of detecting trends such as variations in product spacing or product "stretch" in web applications. As the trend is detected, the M-Track will automatically compensate to maintain correct synchronization, avoiding product waste. And because the M-Track can read quadrature encoders, it can tell whether the line is going forward or backing up. This makes it easier to keep track of movement and compensate for manual adjustments and restarts, resulting in trouble-free operation.

The M-Track's faster response time means it can handle rapid line speeds with digital accuracy. And with the M-Track, you won't have to face the expense of designing long mechanical line shafts. It's easy to program using the simple "by the numbers" system on the front face panel. And because the M-Track can be installed without altering the machinery it interfaces with, the warranties on those machines are preserved intact.

M-Track features a six-digit LED readout. Sealed face panel provides an easy-to-use keypad, with programming functions behind a separate door to simplify day-to-day operations.

Specifications:

Response: 500 micro-seconds
Accuracy (Position) A Resolution \approx one encoder line
 B Holding will be able to develop full output at an error of one encoder line

Accel/Decel: Resolution: 0.1 second
 Range: 0.0 to 600.0 seconds

Inputs: A Feedback and external reference
 1. Encoder (quadrature or incremental)
 2. Signal type: open collector driven, 5 to 12 volts
 3. Frequency
 a. minimum: 0 Hz
 b. maximum: 120 kHz
 B Discrete (14)
 1. Open collector driven, 5 to 12 volts
 2. Frequency: 1000 Hz maximum
 C Sync (2)
 1. Open collector driven, 5 to 12 volts
 2. Maximum sync rate, 20 Hz

Outputs: A Analog speed/torque command
 1. Isolated
 2. 12 bit resolution
 3. Internal or external reference
 4. Unipolar or bipolar
 B Discrete (3)
 1. Open collector drivers
 2. 48 VDC maximum
 3. Diode protected
 C DC supply
 1. +12 volts at 200 mA
 2. +5 volts at 500 mA

Human Interface: A. LED Display
 1. One six character numeric group for quantities
 2. One two character numeric group for variable identification
 3. Five LED annunciators
 B Keypad — N-12 Membrane

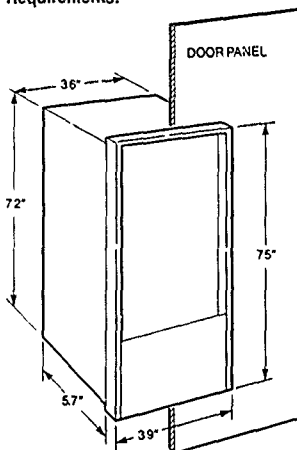
Computer Interface: A Serial link — RS422
 B Multidrop
 C. Baud rates: 9600 max

Power requirements: A. 115 or 230 VAC
 B 50/60 Hz

Packaging: A 1/2 DIN vertical
 B Panel mount

Environmental: A. Temperature: 0 to 50 degrees Celsius
 B Relative humidity, 0 to 90 non-condensing

Panel Requirements:



Fenner

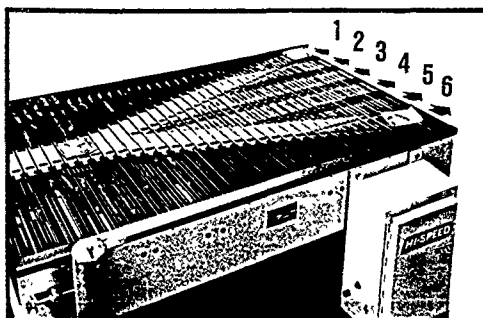
Fenner Industrial Controls
 8900 Zachary Lane North, P.O. Box 9000
 Maple Grove, MN 55369 USA/(612) 424-7800/FAX 424-8734
 A Division of Fenner America Inc.

For more information, call TOLL-FREE 1-800-FIC 4411 and ask for an applications engineer

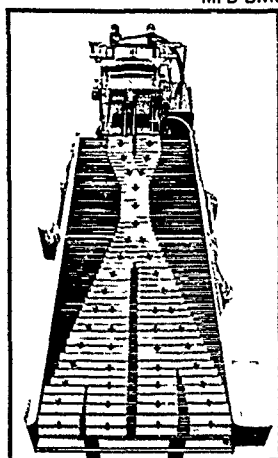
Form DS 388

MFD Line Dividers & Convergents

Automatically Keep Lines Running
Smoothly and at Peak Efficiency



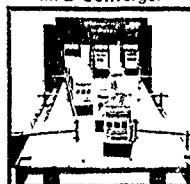
MFD Divider



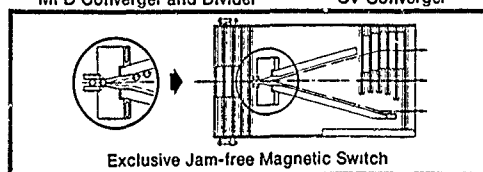
MFD Converger and Divider



MFD Converger



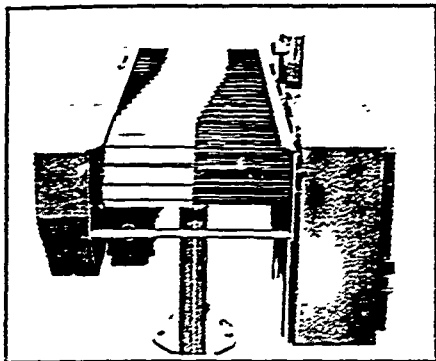
CV Converger



HI-SPEED®

MFD Design Features

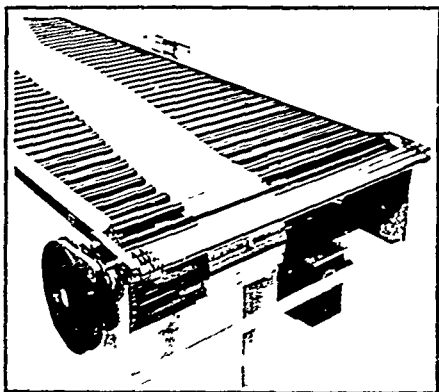
Carefully Engineered and Built for Long Life



The MFD frame is 14" cold rolled steel, machined, drilled and tapped for precision assembly. This results in better alignment, lower maintenance and clean appearance.

All elements are designed and constructed to provide optimum performance, long life and minimum maintenance. Sealed ball bearings are used throughout to reduce lubrication and maintenance. All steel contact surfaces are hardened for minimum wear and long life. Leg castings are designed for sanitary installation. Their tapered and rounded sides eliminate spill-catching flat surfaces.

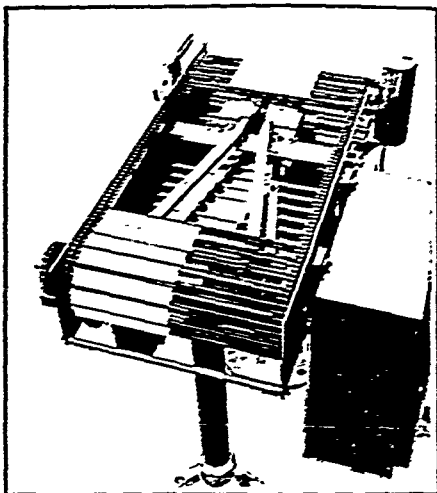
Jam detectors detect product back ups before they reach the MFD. To protect the MFD from damage due to a severe jam, the drive motor is equipped with a torque limiting slip clutch.



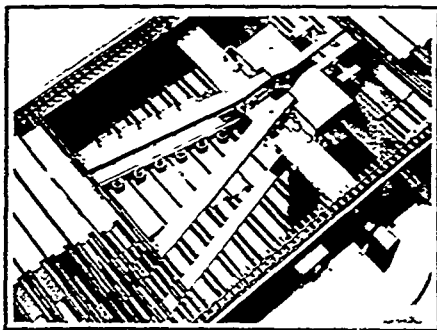
Powered Rollers for Smooth Transfer

Powered inlet and discharge rollers are a desirable MFD option. These rollers insure smooth product transfer on and off of the MFD by eliminating deadplates and other related transfer problems.

Exclusive Jam-Free Switching



The operation of the MFD is simple. Slider rods are carried on two parallel chains. Slider "plaques" move from side to side on the slider rods as they divide or converge products.



The heart of the MFD is an electro and permanent magnet system. Steel rollers on the bottom of the sliders are switched to the proper side by electromagnets and then transferred to the permanent magnet assembly that smoothly guides the slider to the desired lane. This electromagnetic switching system eliminates the jamming problems associated with mechanical pivot type switches that can obstruct and jam sliders.

New Easy to Set-up Digital Converger Control

The new MFD2 Converger control facilitates set-up and changeover. Standard features include keyboard enterable settings and non-volatile multiple product set-up memory. In addition, the new control can accommodate variable speed changes without altering control settings. This eliminates downtime when changing over.

Magnetic Flow Director Specifications

Capacity:

Products weighing up to 50 pounds per foot (parallel to travel), depending on machine design. Heavy duty MFD will handle up to 50 pounds per foot.

Speed:

Up to 500 feet per minute, depending on product dimensions, line requirements and machine design. Maximum speed of heavy duty MFD is 250 feet per minute.

Drive:

1/2 to 1 HP TENV (totally enclosed, non-vented) gear motor. Chain and sprocket power transmission. Torque limiting slip clutch.

Infeed Product Feeding:

Single file. Minimum of 4 - 6" spacing between products or groups, depending on product and speed.

Utilities:

110 volts, 1 phase, 60 cycles, 2 amps, for control. 230/460 volts, 3 phase, 60 cycles for drive motor. Control power should come from clean control grade line, free from transients. If a line free from circuits which drive motor starters, clutches or electromagnetic devices is not available, a line voltage conditioner is recommended.

Divider Patterns:

0-255 (Preselectable) products to each discharge lane before moving to next line. The order of output lanes selected is programmable, allowing lanes to repeat if desired.

Jam Detectors:

Optionally available photoelectrically operated jam detectors and related logic divert product to open lanes or provide a relay contact to stand all products down a single lane, stop upstream operations, etc.

Approvals:

UL Listed control available
USDA Approval available

Options:

Infeed and discharge transfer rollers
Used as a rejector for checkweighers
Special slider carriers to suit product
Variable speed drive
Special paint
Infeed gating conveyors

Finish:

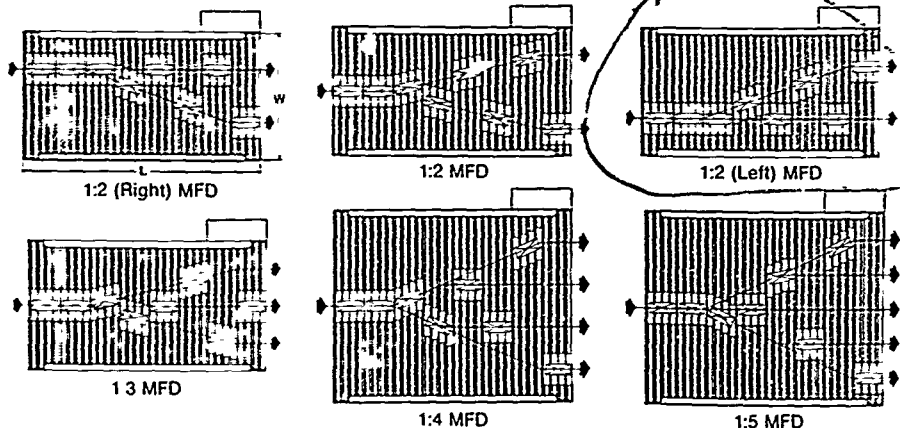
Industrial paint enamel is standard. Stainless steel USDA construction available for washdown conditions.

Control:

Programmable microprocessor-based control mounted in NEMA 12 type enclosure. Features include:

- Permanent data entry storage (EEPROM)
- Multiple product set-up (standard 8, optional 32)
- U.L. Listed or NEMA-4X enclosures available
- Serial communications ASCII
- Optional keyboard and 80 character alphanumeric display
- Keyswitch lockout for keyboard

Standard MFD Divider Patterns



Standard MFD Divider Dimensions:
(3/8" diameter slider rods)

L	W
4'0"	24"
5'0"	30"
5'0"	36"

Heavy Duty MFD Divider Dimensions:
(5/8" diameter slider rods)

L	W
6'0"	42"
7'6"	48"



HI-SPEED®

HI-SPEED CHECKWEIGHER CO., INC.

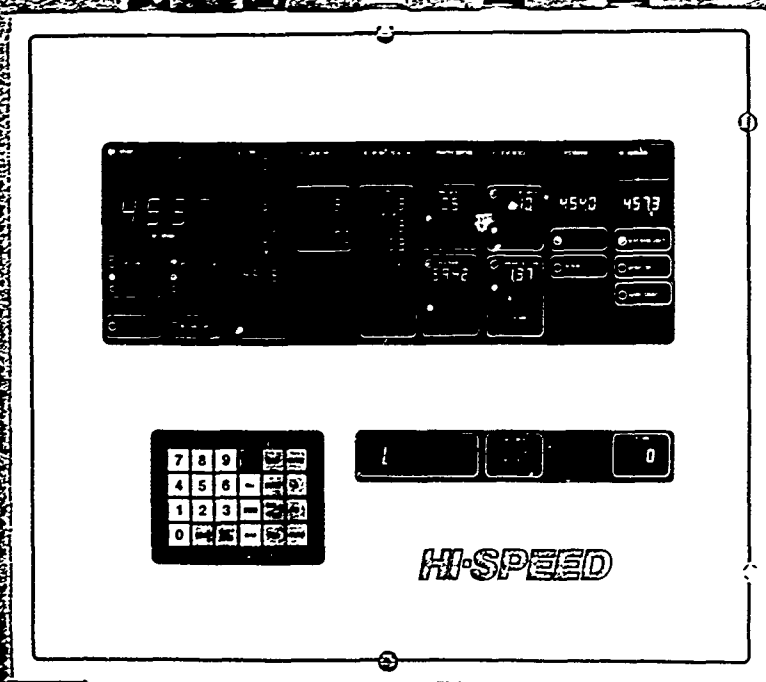
605 West State Street Ithaca New York 14850

Telephone: 607-273-5704 FAX: 607-273-2101



COMPUTA-WEIGH II

The industry's
smartest
checkweigher
control
is also the
most practical!



HI-SPEED

HI-SPEED
THE CHECKWEIGHER COMPANY

COMPUTA-WEIGH II: The Checkweigher Control you can customize to fit your exact record keeping needs.

COMPUTA-WEIGH II: Unbeatable accuracy, sensitivity and statistical capability.

With COMPUTA-WEIGH II, you not only get the most comprehensive on line checkweigher control ever developed, you also get the most practical one.

Not only does COMPUTA-WEIGH II offer more accuracy and more on-board computational and statistical capability than any other checkweigher control, it's also the only control to offer a record keeping package you can customize to include counter, weight totalizer, printer, statistics, histogram, floating zone and feedback modules.

COMPUTA-WEIGH II: More accurate than any other checkweigher control.

COMPUTA-WEIGH II delivers unequal accuracy. Depending on package size and line speed, COMPUTA-WEIGH II is accurate within ± 10 mg. That means less give away and more profit.

Plus you have greater control over your production line. You not only detect under- and over-weights more accurately than ever before, you can make necessary line adjustments faster.

With our large displays, your operators can read precise weights in any common unit: in grams, kilograms, ounces, pounds and piece count.

These units may be displayed as either the actual weight of the product, or as plus/minus deviation from your pre-entered target weight.

COMPUTA-WEIGH II: Never before has a checkweigher control been easier to operate.

COMPUTA-WEIGH II has been designed for easy, error-free operation. There are no obsolete thumbwheels, potentiometers or toggle switches to wear out and create service problems.

Instead, your operators use a color-coded "plain English" keypad that makes data entry easy and accurate.

Should your operator enter information in the incorrect sequence, the error is indicated on the entry display.

COMPUTA-WEIGH II also ends time-consuming calibration procedures. With

dynamic calibration your operator simply passes a single package over the scale, or, at your option, multiple packages. The data is entered automatically and verified through visual display.

① **CALIB/CALL** — "Calib" allows for static calibration, eliminating the need for time-consuming "adjust-and-try" calibration procedures. Bypassing this key and using a simple keyboard command allows for dynamic, single-pass calibration. "Call" is a special function key.

② **PRODUCT** — allows instant call up of any of the 15 pre-entered product parameters.

③ **CLEAR** — zeros the accumulated data.

④ **ENTER** — access key to input data into memory.

⑤ **NO TOTALS** — allows test products to be run without affecting the accumulated product information stored in memory.

⑥ **SAMPLE** — automatically ejects the next package from the line and holds the package weight on the keyboard display for operator verification. This provides for an actual product check on accuracy without stopping or interfering with production line operation.

⑦ **KEYPAD** — color-coded sealed membrane design, with plain English commands.

⑧ **ADDRESS, ROLL, STATUS, WEIGH, REZERO, "A" and "B"** — are function keys that assure proper data entry.

⑨ **KEYCODE** — permits bypass of key lock to all set-up changes by operator once the numerical password has been entered.

⑩ **ENTRY DISPLAY** — allows operator to review and, if necessary, correct input prior to entry into the control memory. Entering information in the wrong sequence will be indicated, allowing the operator to key-in correct data.

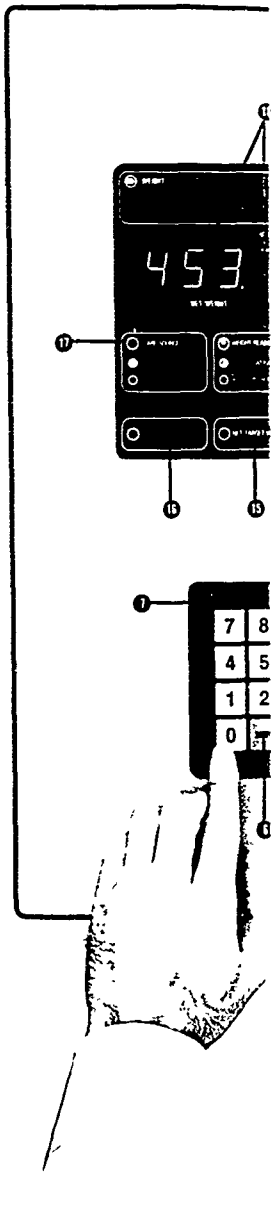
⑪ **PRODUCTION RATE DISPLAY** — a digital "packages per minute" readout is available as an option, to provide an instantaneous measure of the packaging line speed.

⑫ **GOOD REZERO** — indicates that the scale is automatically rezeroed every time there is a gap of one or more packages in the production flow.

⑬ **NEED REZERO** — alerts the operator to excessive product build-up on the scale or that automatic rezero is overdue.

⑭ **SCALE ALERT** — indicates possible incorrect package weight readings, which may occur for various reasons, such as poor package transfer.

⑮ **NET TARGET WEIGHT** — displays and verifies the operator's input of net product weight.



COMPUTA-WEIGH II

General Specifications

Control Features

- 15 product capability
- 16 reject stations
- 16 weight zones
- Key code/key switch security
- Tare weight display
- Weight display in gross, net, or deviation from target
- Digitally set (quartz accurate) timers
- Simultaneous displays
- Entry display for operator verification
- Weight and zone modules standard

Displays

- Weight readout .8" high, 4 digit
- Keyboard .56" high, 5 digit
- All other displays .4" high

Enclosure Designed to Meet Specifications for:

- NEMA 4, epoxy painted, water tight, dust tight — standard
- NEMA 4X, stainless steel, water tight, dust tight, corrosion resistant — optional
- Dimensions 20" H x 24" W x 12" D

Operating Environment

- Temperature — 0-38°C
— 32-100°F
- Humidity 100% noncondensing
- Designed for continuous operation
- Flammable atmosphere — air purge system optionally available for Class I or Class II locations

Electrical

- 115 VAC $\pm 10\%$ — single phase
- 50/60 Hz @ 2.5 amps — (300 VA power rating)
- Other voltages available
- Externally mounted isolating regulating transformer — standard

Technology

- 8-bit distributed industry standard multi-processor
- EPROM (non-volatile) memory for storage of set-up parameters
- EPROM program memory
- CMOS RAM for entered and accumulated data
- RAM battery backup (memory retention with power interruption) — 200 hours nominal
- Parallel BCD and serial ASCII output computer interfaces optionally available

Keypad

- Tactile membrane type — 24 key environmentally sealed

Self-Diagnostics

- Auto memory test A/D functional test display check power supply indicators input/output indicators
- Self-checking during operation

Auto-Rezero

- Rezeroes automatically instant or incrementally for sustained zero accuracy

Scale

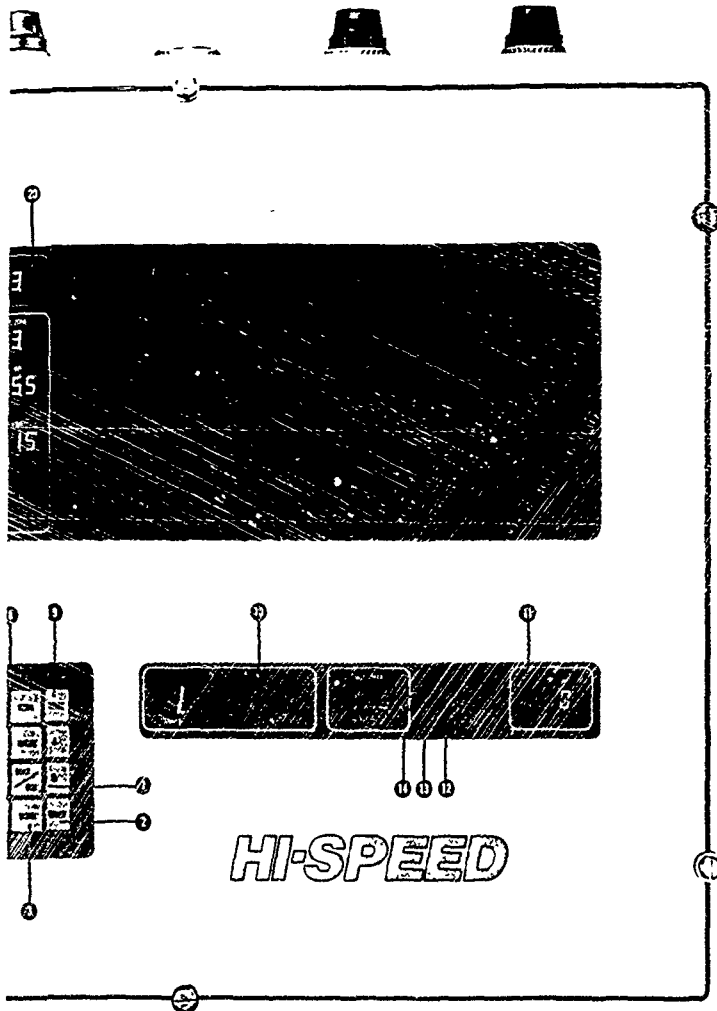
- Self-checking display monitors scale operations and indicates:
 - Good rezero
 - Need rezero
 - Scale alert

General

- Zone indicating lights optional
- Audible alarm optional
- 7 optional modules for all statistical and control needs

HI-SPEED
THE CHECKWEIGHER COMPANY

HI-SPEED CHECKWEIGHER CO., INC.
605 West State St., Ithaca, NY 14850
Tel (607) 273-5704 FAX 607-273-2101
1 (800) 847-7191 / In New York State, 1 (800) 252-2324



**COMPUTA-WEIGH II:
No other checkweigher
control has the capability
of up to sixteen zone
configurations.**

Today a checkweigher's ability to recognize the weight of a product is only a fraction of its job. With COMPUTA-WEIGH II, you'll also be able to detect shades of

deviation in product weights in any of these different zone configurations: three (3), five (5), eight (8), and sixteen (16).

This enhanced capability, when used in conjunction with optional record keeping modules such as the histogram, will provide useful data on production trends. COMPUTA-WEIGH II can also reject or accept products in any weight zone.

A floating zone module can be used to confirm correct piece counts on products where individual weights fluctuate with product variations.

Large, individually colored zone indicator lights provide your operator with visual indications of under, over, and acceptable weights. These lights offer just one more means of double-checking even the busiest operation.

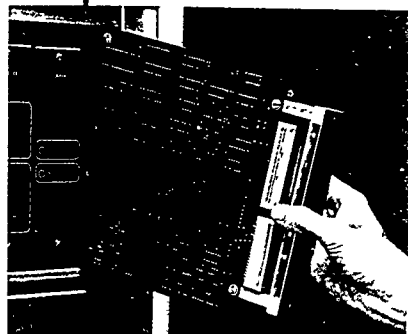
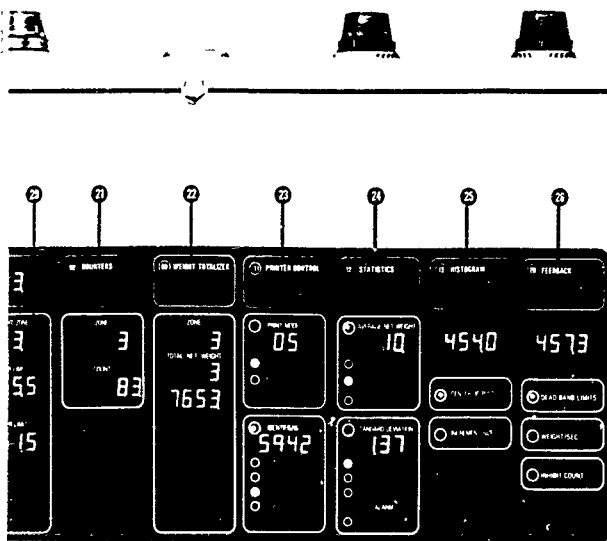
**COMPUTA-WEIGH II:
50% more product
capability than any
other checkweigher.**

With COMPUTA-WEIGH II, set-up and change-over has never been faster or easier. At just the touch of a button, COMPUTA-WEIGH II stores tare weight, target weight, reject points and timer reject settings for up to fifteen different products. Option available for up to forty different product codes.

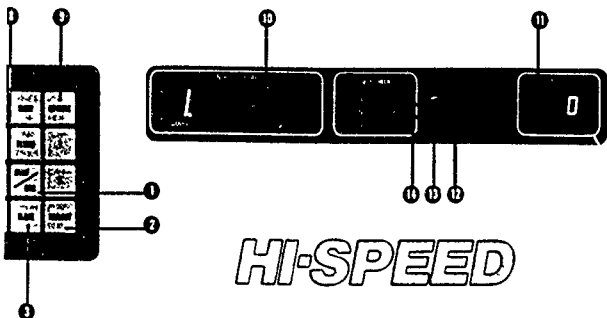
This makes simple set-up and instant change-over a reality even for very complex operations. And, it keeps your production line moving profitably during product change-overs.

**COMPUTA-WEIGH II:
The only checkweigher
control with the
advantage of up to
sixteen reject stations.**

COMPUTA-WEIGH II offers more reject stations for classifying checkweighers than any other competitor. The proximity of these reject stations, in conjunction with their number, gives you unequalled on-line control. Whether you require single rejector for problem products or multiple stations for accurate classifying, HI-SPEED can do the job.



Plug-in, record keeping modules can be ordered as factory installed options or added in-the-field for expansion of COMPUTA-WEIGH's capabilities.



HI-SPEED

- 10 **TIMERS** — shows settings for reject optional indicator lights and reject
- 11 **TARE** — displays weight of empty tainer, allowing for net weight read
- 12 **WEIGHT** — shows the actual net weight of your product or variation as a plus or minus from target
- 13 **ZONE** — indicates the zone of the last package weighed
- 20 **WEIGHT ZONE** — indicates the zone's lower and upper limits



In case of power failure or brown-outs, COMPUTA-WEIGH II has a battery-power emergency back-up system that will power its functions for up to 200 hours.

COMPUTA-WEIGH II: Designed to survive the most demanding conditions.

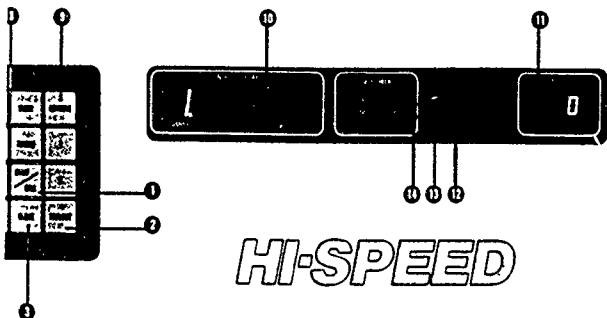
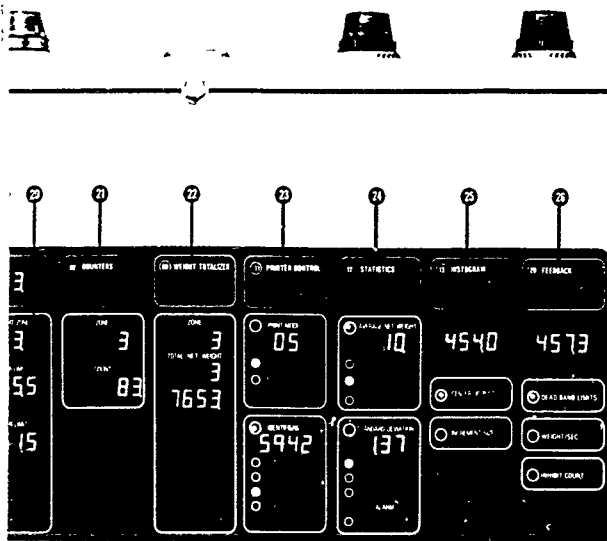
COMPUTA-WEIGH II gives you the reliability and environmental immunity you need. The NEMA-4 wash down enclosure is standard. Each control is UL listed and serialized. COMPUTA-WEIGH II has been carefully engineered to withstand power line spikes, surges, even electrostatic discharge.

The keypad is sealed with a pliable, long-lasting plastic membrane that protects both the keys and the electronics behind them from environmental contamination.

COMPUTA-WEIGH II: Unique self-diagnostics for highest reliability.

COMPUTA-WEIGH II monitors itself as it controls your production line.

Continuous self-checking features are built in to insure easy troubleshooting, maintenance and operation. Operating messages provide visual verification that the checkweigher is functioning.

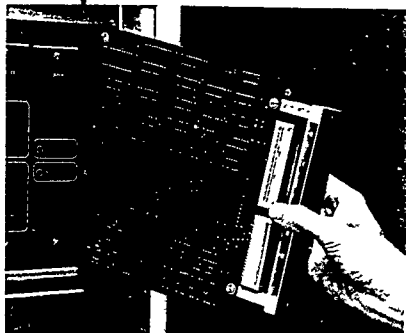


COMPUTA-WEIGH II: Unique self-diagnostics for highest reliability.

COMPUTA-WEIGH II monitors itself as it controls your production line.

Continuous self-checking features are built in to insure easy troubleshooting, maintenance and operation. Operating messages provide visual verification that the checkweigher is functioning

properly and weighing accurately. In the event of a failure, the problem is immediately identified and displayed.



Plug-in, record keeping modules can be ordered as factory installed options or added in-the-field for expansion of COMPUTA-WEIGH's capability.

- 15 **TIMERS** — shows settings for reject optional indicator lights and reject
- 16 **TARE** — displays weight of empty tainer, allowing for net weight read
- 17 **WEIGHT** — shows the actual net weight of your product or variation as a plus or minus from target
- 18 **ZONE** — indicates the zone of the last package weighed
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In case of power failure or brown-outs, COMPUTA-WEIGH II has a battery-power emergency back-up system that will power its functions for up to 200 hours.

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The keypad is sealed with a pliable, long-lasting plastic membrane that protects both the keys and the electronics behind them from environmental contamination.

TRAY PACK CONVEYOR LINE

Statement of Work

Objective

Design, develop a tray pack conveyor line to fill tray pack cans at production rates of 5 to 25 trays per minute.

Scope

- Design and fabricate a tray pack filling conveyor (tabletop chain) to operate at a continuous rate between 5 and 25 trays per minute. Conveyor to be 20 feet long and have adjustable lugs and side rails to transport tray sizes from 6" square to 12" square.
- Design and fabricate a spacing and phasing fabric belt conveyor 20" long.
- Design and fabricate a reject tray and discharge conveyor 6' long of tabletop chain.
- Connect all conveyors electrically using Fenner M-Track and M-Trim controllers so that the complete line is synchronized with the Seamer infeed conveyor.
- Wire the Seamer control cabinet. Replacing relays with a PLC with math capability.
- Assemble and test complete line that will include:
 - Tray pack filling conveyor
 - Spacing conveyor
 - Checkweigher
 - Reject diverter & reject conveyor
 - Phasing conveyor
 - Yaguchi Seamer and discharge conveyor
- All equipment to be stainless steel and meet USDA standards.
- Rutgers University will supply the Yaguchi Seamer, Checkweigher and Reject Diverter.
- Ship complete line to Rutgers University, install and provide startup assistance.
- Supply a set of line layout drawings, list of spare parts and an operating and maintenance manual.



November 7, 1989

Mr. Ken Lewis
Enterprise Electric, Inc.
549 East 3rd Street
Plainfield, New Jersey 07060

Dear Ken:

As a follow up to our meeting, enclosed are the photos of the Yaguchi Seamer, the Statement of Work, Seamer electrical schematic and a revised line layout.

We would appreciate a quotation as soon as possible. Please call me at 201-932-9669 if there are any questions.

Sincerely,

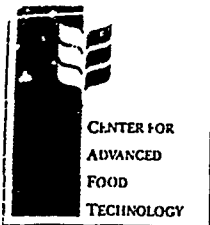
Ted Descovich
Engineering Consultant

TD:d

cc: A. Sigethy

Nabisco Advanced
Food Technology Institute
Cook College
P O Box 231
New Brunswick, NJ 08903-0231
201/932-8306

THE STATE UNIVERSITY OF NEW JERSEY
RUTGERS



November 10, 1989

Mr. Jack Hayden
Raque Food systems, Inc.
11002 Decimal Drive
P.O. Box 99416
Louisville, KY 40299

Dear Jack:

As a follow up to our meeting yesterday, enclosed are the photos of the Yaguchi Seamer, the Statement of Work, Seamer electrical schematic and a revised line layout.

We would appreciate a quotation as soon as possible. Please call me at 201-932-9669 if there are any questions.

Sincerely,

Ted Descovich
Engineering Consultant

TD:d

cc: A. Sigethy

Nabisco Advanced
Food Technology Institute
Cook College
P O Box 231
New Brunswick NJ 08903 0231
201/932 8306

STATE UNIVERSITY OF NEW JERSEY
RUTGERS



CENTER FOR
ADVANCED
FOOD
TECHNOLOGY

November 7, 1989


Mr. Horst Boellmann
Per-Fil Industries
407 Adams Street
P. O. Box 9
Riverside, New Jersey 08075

Dear Horst:

As a follow up to our meeting last week, enclosed are the photos of the Yaguchi Seamer, the Statement of Work, Seamer electrical schematic and a revised line layout.

We would appreciate a quotation as soon as possible. Please call me at 201-932-9669 if there are any questions.

Sincerely,


Ted Descovich
Engineering Consultant

TD:d

cc: A. Sigethy

Nabisco Advanced
Food Technology Institute
Cook College
P. O. Box 231
New Brunswick, NJ 08903-0231
201/932-8306

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TECHNOLOGY

November 7, 1989

Mr. Joe McBride
Precision Automation Company, Inc.
Box 18
Haddonfield, New Jersey 08033

Dear Joe:

As a follow up to our meeting last week, enclosed are the photos of the Yaguchi Seamer, the Statement of Work, Seamer electrical schematic and a revised line layout.

We would appreciate a quotation as soon as possible. Please call me at 201-932-9669 if there are any questions.

Sincerely,

Ted Descovich
Engineering Consultant

TD:d

cc: A. Sigethy

Nabisco Advanced
Food Technology Institute
Cook College
P O Box 231
New Brunswick, NJ 08903 0231
201/932 8306

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RUTGERS



November 7, 1989

Mr. Walter McDonald
Norwalt Design, Inc.
961 Route 10 E. Bldg. 2A
Randolph, NJ 07869

Dear Mr. McDonald:

As a follow up to our meeting, enclosed are the photos of the Yaguchi Seamer, the Statement of Work, Seamer electrical schematic and a revised line layout.

We would appreciate a quotation as soon as possible. Please call me at 201-932-9669 if there are any questions.

Sincerely,

Ted Descovich
Engineering Consultant

TD:d

cc: A. Sigethy

Nabisco Advanced
Food Technology Institute
Cook College
P.O. Box 231
New Brunswick, NJ 08303-0231
201/932-8306

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TECHNOLOGY

November 7, 1989

Mr. Richard Berkof
United Engineers & Constructors
30 South 17th Street
P. O. Box 8223
Philadelphia, PA 19101

Dear Dick:

As a follow up to our meeting last week, enclosed are the photos of the Yaguchi Seamer, the Statement of Work, Seamer electrical schematic and a revised line layout.

We would appreciate a quotation as soon as possible. Please call me at 201-932-9669 if there are any questions.

Sincerely,



Ted Descovich
Engineering Consultant

TD:d

cc: A. Sigethy

Hadisco Advanced
Food Technology Institute
Cook College
P. O. Box 231
New Brunswick, NJ 08901-0231
201/932-8208

THE STATE UNIVERSITY OF NEW JERSEY
RUTGERS

COMBAT RATION
ADVANCED MANUFACTURING
TECHNOLOGY DEMONSTRATION
(CRAMTD)

Revised Automation Control Strategy
For Tray Pack Filling/Sealing Line
Technical Working Paper (TWP) 14

Alex Sigethy
Theodore Descovich
Thomas O. Boucher
CRAMTD
Rutgers University
September, 1990

Sponsored by:
DEFENSE LOGISTICS AGENCY
Cameron Station
Alexandria, VA 22304-6145

Contractor:
Rutgers, The State University of New Jersey
THE CENTER FOR ADVANCED FOOD TECHNOLOGY*
Cook College
N.J. Agricultural Experiment Station
New Brunswick, New Jersey 08903

DR JACK L. ROSSEN
Program Director, CRAMTD

TEL 908-932-8306
FAX 908-932-8690

1.0 Introduction

This report addresses in part program Item 4.5.1 of CRAMTD Management Master Plan. This program item requires an update and refinement of the control strategy plan in accordance with final process specifications for the CRAMTD pilot plant. This report will focus on the tray pack filling and sealing line.

2.0 Tray Pack Line Equipment Specification

Figure 1 illustrates the mechanical design of the tray pack line. There are three major subsystems: Filling Line, Check Weigh/Diverter, and Sealing Line.

The filling line consists of a power conveyor and automatic filling equipment. The check weigher/diverter includes a speedup conveyor, followed by a checkweigher for ascertaining weight, and a fiber optic sensor for detecting the presence of material above the lid line. A reject diverter will reject a tray based on under weight or presence of a mound. The sealing line includes a conveyor for trays and lids, a seamer, and a discharge conveyor for sealed trays. A list of the equipment and sources for these three subsystems is given in Table I.

3.0 Tray Pack Line Equipment Operation

We will use Figure 1 to describe the general operation of the tray pack line. The product being described is Beef Cubes in Gravy (Mil-B-44230A). Trays will be denested manually and placed on the power conveyor. The conveyor is equipped with adjustable plastic lugs that retain the tray in position. There are three filling operations. The first filling operation is a partial gravy fill. This is done from a volumetric piston filler. This

operation is followed by filling of the beef cubes. A weigh filler, which provides precise weight control, will be used for this operation. It is our intention to evaluate other filling methods; here we will assume the weigh filler for beef filling. The last filling station will be the remainder of the gravy, dispensed by a volumetric piston filler.

The filling machines are operated intermittently, while the filling conveyor is operated continuously. Each filling station is equipped with a photosensor (not shown). When a tray enters a filling station, the filler is cycled. It is necessary to check for the presence of a tray at each station before cycling the filler at that station; this is accomplished by the use of the photosensor.

During initial operation of the system at the CRAMTD Pilot Plant, the first two filling stations will be manual. Fillers for these stations will not be installed until the latter stages of CRAMTD phase I.

The speedup conveyor provides a smooth acceleration from the filling conveyor to the checkweigher. The checkweigher serves as both a check on a quality parameter (minimum total weight) and as a data logging device. The checkweigher provides statistical data on underfills and weight distribution. The checkweigher is interfaced with the diverter conveyor for automatically rejecting product.

A phasing conveyor follows the checkweigher. Its purpose is to phase trays onto the seamer conveyor without interference with the lugs of the seamer conveyor.

Acceptable trays are transported along the seamer conveyor. Lids are automatically denested and placed on the seamer's lid conveyor, from whence they are transported and mated with a tray. After the seamer has sealed the lid to the tray, the finished tray is discharged down a gravity conveyor.

It is estimated that seven workers are required to maintain the operation of the line at 20 trays per minute. Five workers will be required to denest, wash, and place trays at the front end of the line. A future STP will be proposed to automate this operation. Two workers will be required to clear the discharge conveyors for finished trays and reject trays. One worker will also have responsibility to refill the lid magazine as required.

4.0 Tray Pack Line Control Strategy

Section 3.0 described the overall operation of the tray pack line. In this section we describe the control hardware and software configuration.

4.1 Hardware Configuration

Overall control of the tray pack line will be handled by a programmable logic controller, the Allen Bradley PLC 5/10. The standard Yaguchi seamer is wired with a relay panel. This machine will be rewired and interfaced to the AB PLC 5/10. There will be no alterations to the control logic of the Yaguchi seamer as a result of this rewiring. The AB PLC 5/10 will oversee other functions of the tray pack line as shown in Figure 2, which is a block diagram showing outputs from and inputs to the PLC 5/10.

4.1.1 Control of Conveyors

The hardware configuration of the conveyor system is

shown at the left side of Figure 2. Part of the operating logic of the Yaguchi seamer is the motor control. The Yaguchi motor is a variable speed AC motor, which drives the Yaguchi seamer and the seamer conveyor, including lid dispenser. The starting and stopping of this motor is under direct control of the PLC 5/10.

The Yaguchi motor will provide a reference speed that will be used to set the speeds of the motors that drive the upstream conveyors in the tray pack filling/sealing line. This is done by using a Fenner M-Trim controller for each motor whose speed is being synchronized to the speed of the Yaguchi sealing line. The seven conveyors involved are shown in Figure 1.

Figure 3 is a block diagram that illustrates the format for a typical motor. The Yaguchi motor provides the external reference frequency. This is accomplished by mounting an encoder kit on the Yaguchi driveshaft and outputting that signal to the M-Trim. The operator can enter a ratio setpoint, which will control the speed of the follower motor to be proportional to the Yaguchi motor. The M-Trim controls the follower motor drive by receiving feedback from the follower motor and comparing the follower motor speed to the external reference speed and operator setpoint. The follower motor feedback device is either a magnetic pickup device or inductive proximity sensor unit mounted on the motor shaft. The Yaguchi seamer uses the inductive proximity sensor and picks up the teeth on the manual drive gear.

There are two points to note about this configuration. The first is that the master motor to follower motor ratios only need to be set once for a standard tray pack; the ratio does not

require continuous control. This is the case because the synchronization of conveyor speed is fixed by the tray size. When there is a changeover to other container sizes, the ratios will have to be reset to accommodate the new size.

The second point is that a change in line speed is controllable from the Fenner M-Trim. The output rate of the Yaguchi seamer is controlled by an AC variable frequency drive with a Fenner M-Trim to synchronize follower motors with the speed of the Yaguchi seamer.

4.1.2 Control of Filling

Refer to Figure 2. There are three digital inputs and three outputs for the filling operations, one input/output pair for each station. The input is a photosensor that detects the presence of a tray. The sensor is positioned such that it detects the leading edge of the tray as it moves under the filler. When the sensor input is enabled, the PLC 5/10 will delay a preset amount of time before enabling the filler, which will cycle through a single fill. The PLC 5/10 will not reset until the tray has cleared the photosensor. This will complete the sense-fill-reset cycle.

In this operation there will not be any return signal from the filler indicating the fill is complete. Timing of the conveyor or speed with tray width and filling time will insure that the fill is complete. This also means that it may be necessary to change parameters of the controller functions if tray size is changed. Malfunctions of the filling operations are detected during checkweighing.

4.1.3 Control of Checkweighing

The checkweigher/diverter subsystem operates through the PLC 5/10. When an underweight tray is detected, a digital signal from the checkweigher controller is sent to the PLC 5/10 which sends a signal to the reject diverter, which diverts the tray to the reject conveyor. The checkweigher controller will report the status (accept/reject) of trays to the PLC 5/10.

The checkweigher controller, operating independently, will maintain other important production data, such as the weights of a sample tray, the cumulative average weight and the standard deviation of tray weights.

The reject diverter conveyor will also divert trays in which ingredients are above the lid line, preventing placement of the lid for sealing. This is the function of the mound detector, which provides a digital input to the PLC 5/10. For these cases, the PLC 5/10 will output a digital signal to reject diverter.

Finally, the reject conveyor will be equipped with a photoeye that will indicate when the conveyor is full. This will signal the 5/10 to stop operation until the conveyor is cleared.

4.1 Software Control

Programming the ladder logic diagram is the responsibility of the subcontractor. The functions required have been indicated in the previous sections. Figure 4 is a flowchart diagram that indicates the general structure of the control logic.

The cycle of events is straightforward. What is not shown in Figure 4 are the normal checks made by the control logic of the Yaguchi seamer; i.e., a check to see if a lid and tray are in

proper position to be mated.

One control point, not previously discussed, is "N of M weight rejects". This will be resident in software in the PLC 5/10. It is a check against a run of trays that are out of tolerance on weight. If at least N rejects occur in the last M trays that are weighed, the operation will be stopped.

5.0 Summary

This document provides an update to the control strategy to be used for the tray pack filling/sealing line. It is meant to be used to inform individuals concerned with these developments and to serve as a working document for further enhancements. It also serves as a reference document for developing a Software Requirements Specifications.

TABLE I

Major Equipment for Tray Pack LineEquipment/Description

FILLING LINE

- | | |
|--|---------------------------|
| 1. Power Conveyor for Filling Operations
Stainless Steel, Chain Type,
20' Long | Nedco Conveyor
Company |
| 2. Volumetric Piston Filler | Raque |
| 3. Weigh Filler | TBD |

TRANSFER/CHECKWEIGH/DIVERTER

- | | |
|---|---------------------------|
| 4. Speedup Conveyor, Stainless Steel, 5' Long | Nedco Conveyor
Company |
| 5. Checkweigher | Hi-Speed |
| 6. Fiber Optic Photoeye for Mound Detection | Banner |
| 7. Diverter Conveyor, Stainless Steel,
Magnetic Flow Type, 7' Long | Hi-Speed |
| 8. Power Conveyor at Reject Discharge | Nedco Conveyor
Company |

SEALING Line

- | | |
|---|---------------------------|
| 9. Tray Pack Seamer, Associated Conveyor,
and Automatic Lidder | Yaguchi |
| 10. Gravity Conveyor at Seamer Discharge | Nedco Conveyor
Company |

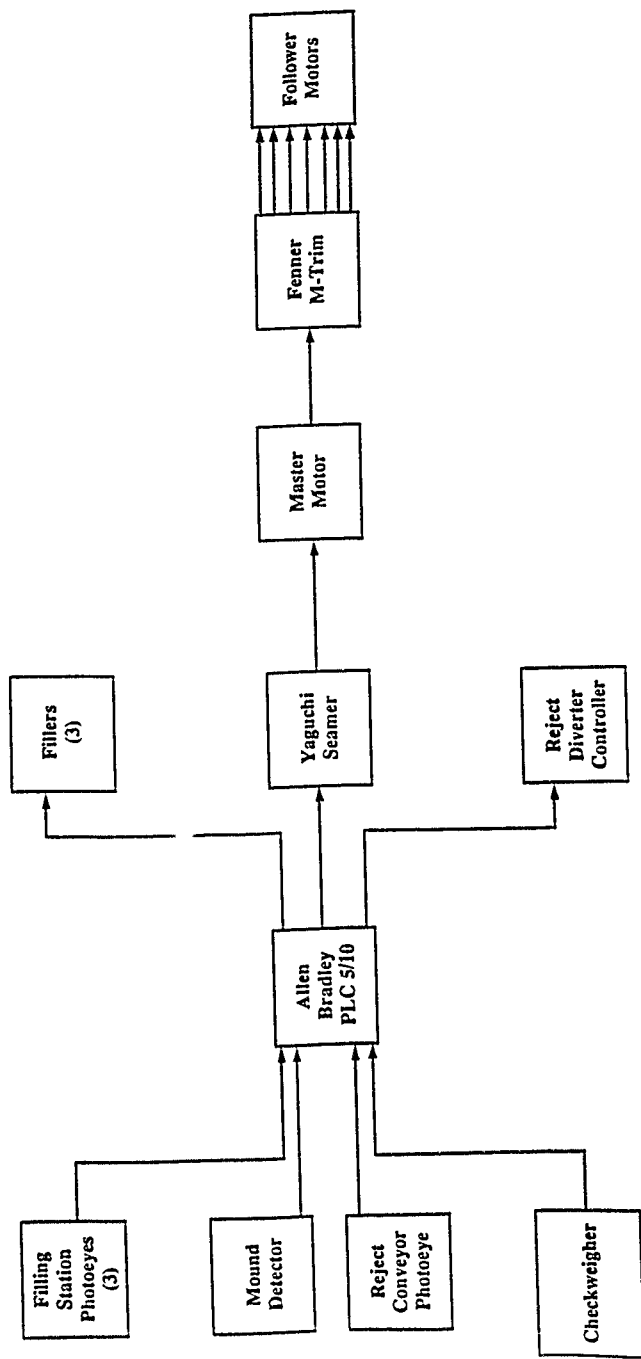


Figure 2 - Control hardware configuration for final design of tray pack filling/sealing line

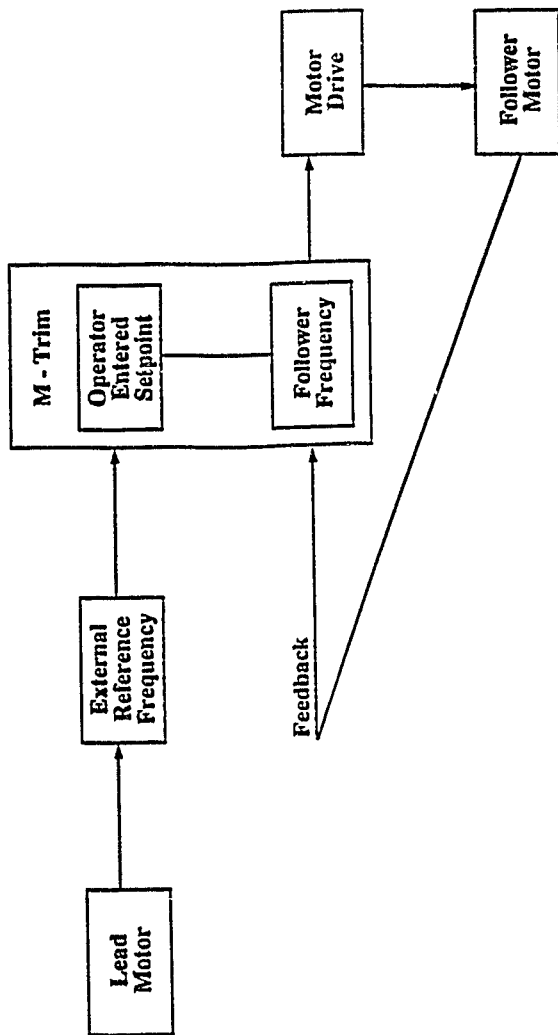


Figure 3 - Leader Motor/Follower Motor Format Functional Diagram

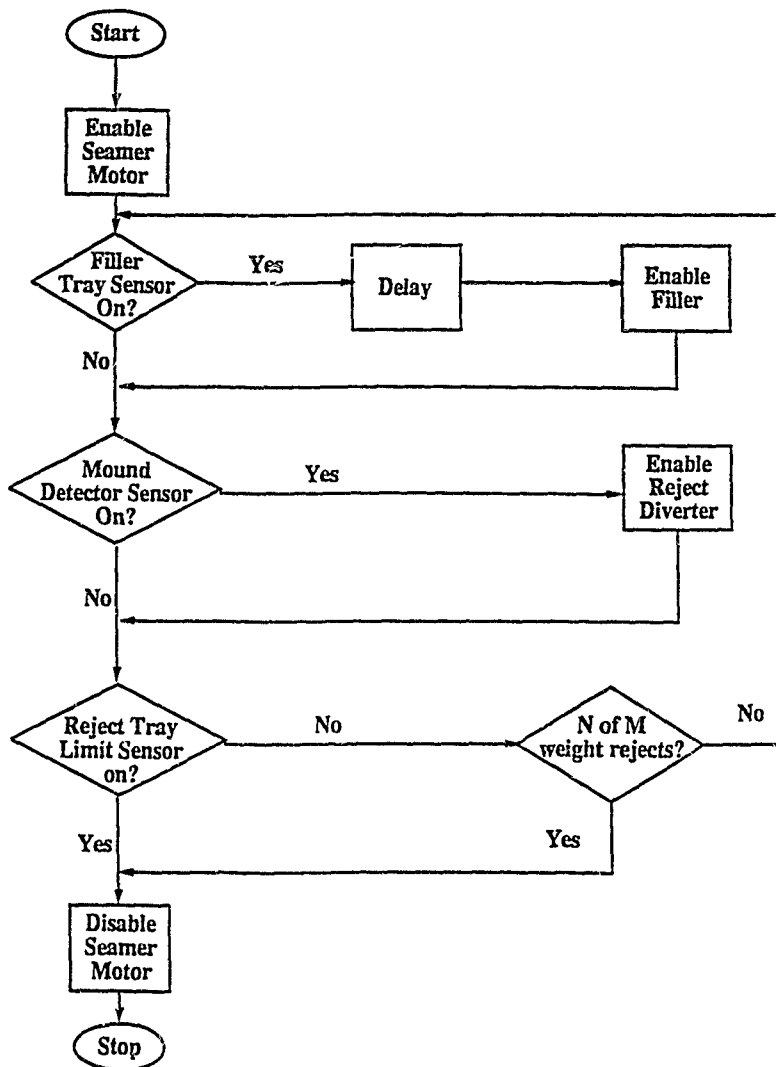


Figure 4 - Flow Chart of Overall PLC 5/10 LOGIC

Memo: Jack Rossen
From: Ted Descovich *TD*
Date: October 22, 1990

Subject : Acceptance Test on Enterprise Electric - STP #1

Attached is the Acceptance Test Criteria for STP #1
The Powered Tray Pack Conveyor Line was cycled through all four
items satisfactory on October 17, 1990.

cc: J. Coburn

ACCEPTANCE TEST - STP#1

Enterprise Electric, Inc.
549 East 3rd Street
Plainfield, New Jersey 07060

- * Start Tray Pack Powered Conveyor Line at low speed (5/min.) and increase speed until maximum of 20/min. with no trays on line. for 15 minutes.
- * Operate line continuously at maximum speed of 20 trays per minute for 5 minutes with no product to check for operation of entire system..
- * The trays must move smoothly through the entire system; filling conveyor, spacing conveyor, checkweigher conveyors, phasing conveyor and into the Seamer conveyor without sloshing with water in the trays. This test shall be done by putting at least 10 trays on the filling conveyor, filling the trays with water or corn starch in the water and starting up the line and attain a rate of 20 trays per minute.
- * Trays to be put on the filling conveyor at random to check the operation of the lid dispenser clutch modification (no tray-no lid).

- Note
- 1 Spare part list.
 - 2 Drawings
 - 3 Operating manuals.
 - 4 Software data
 - 5 Electrical drawings

COOK COLLEGE CAFT
R&D PROTOTYPE
MANUAL

PROJECT 1289-192-C

PRESENTED BY

ENTERPRISE ELECTRIC, INC.
549 EAST THIRD STREET
PLAINFIELD, NJ 07060

(908) 561-7774 - Tel
(908) 561-2663 - Fax

COOK COLLEGE MANUAL

I MACHINE DESCRIPTION

THIS MACHINE IS DESIGNED TO FILL, WEIGH, AND SEAL FILLED STEAM TABLE TRAYS.

SYNCHRONIZATION OF THE CONVEYORS IS ACCOMPLISHED BY ELECTRONIC LINE SHAFTHING WHICH IS SUPERVISED BY A FENNER M-TRACK SYSTEM.

THE SYSTEM CONSISTS OF THE FOLLOWING COMPONENTS:

- A: FILLER CONVEYOR
- B: SPACING CONVEYOR
- C: CHECKWEIGHER / MOUND DETECTOR
- D: REJECT DIVERTER
- E: REJECT CONVEYOR
- F: PHASING CONVEYOR
- G: YAGUCHI SEAMER
- H: DISCHARGE CONVEYOR

A: FILLER CONVEYOR:

EMPTY TRAYS ARE PLACED ON THIS CONVEYOR AND ARE AUTOMATICALLY FILLED.

B: SPACING CONVEYOR:

THIS CONVEYOR INCREASES THE SPACE BETWEEN TRAYS TO INSURE PROPER OPERATION OF THE REJECT DIVERTER.

C: CHECKWEIGHER / MOUND DETECTOR:

THE CHECKWEIGHER WEIGHS EACH TRAY AND IF THE TRAYS WEIGHT FALLS OUTSIDE OF THE PRESET PARAMETERS,

(2)

IT IS REJECTED. THE MOUND DETECTOR CONSISTS OF A PHOTO-EYE (PE-5) WHICH SCANS OVER THE TOP OF THE TRAY. IF THIS PHOTO-EYE BEAM IS BROKEN THE TRAY IS REJECTED.

D. REJECT DIVERTER

THIS CONVEYOR ROUTES THE TRAY TO THE PROPER CONVEYOR AS DETERMINED BY THE CHECKWEIGHER / MOUND DETECTOR.

E. REJECT CONVEYOR:

THIS CONVEYOR RECEIVES TRAYS REJECTED BY THE CHECKWEIGHER AND MOUND DETECTOR. WHEN A TRAY IS SENT TO THE REJECT CONVEYOR A PHOTO-EYE, LOCATED AT THE DISCHARGE OF THE CHECKWEIGHER (PE-3) SENSES THE TRAY AND STARTS THE REJECT CONVEYOR. THE CONVEYOR RUNS UNTIL THE PHOTO-EYE (PE-3) IS CLEARED. A PHOTO-EYE (PE-2) IS LOCATED AT THE END OF THE REJECT CONVEYOR. WHEN A TRAY IS SENSED BY THIS PHOTO-EYE (PE-2) THE SYSTEM IS SHUT DOWN (REJECT CONVEYOR FULL).

F: PHASING CONVEYOR:

THE PURPOSE OF THIS CONVEYOR IS TO TRANSFER THE TRAYS WITHOUT INTERFERENCE WITH THE LUGS OF THE YAGUCHI SEAMER CONVEYOR.

G: YAGUCHI SEAMER

THE YAGUCHI SEAMER MATES THE FILLED TRAYS WITH A LID AND SEALS THE LID TO THE TRAY.

(3)

H: DISCHARGE CONVEYOR

THE FINISHED TRAYS ARE DEPOSITED ONTO THIS GRAVITY
CONVEYOR.

II OPERATING INSTRUCTIONS:

A: OPERATORS CONTROL PANEL

THE OPERATORS CONTROL PANEL INCLUDES ALL SWITCHES
AND PILOT LIGHTS NECESSARY TO CONTROL AND MONITOR
THE SYSTEM.

B: START / STOP PUSH BUTTONS

1. MCR ON / OFF: THIS SET OF PUSH BUTTONS ENERGIZES
THE CONTROL CIRCUIT TO THE P.L.C. OUTPUT MODULES.
WHEN THIS CIRCUIT IS ENERGIZED THE GREEN PILOT
LIGHT WILL BE ILLUMINATED. THE MCR (OFF) IS A
MAINTAINED TYPE PUSHBUTTON AND WHEN DEPRESSED
(OFF) IS ILLUMINATED (RED). THIS PUSHBUTTON MUST
BE PULLED OUT BEFORE THE MCR (ON) CIRCUIT CAN BE
ACTIVATED.
2. SYSTEM START / STOP: WITH THE AUTO-MANUAL
SELECTOR SWITCH IN THE AUTO POSITION THIS SET OF
PUSH BUTTONS CONTROLS THE START / STOP OF THE
SYSTEM, IF SAFETY FAULTS ARE NOT PRESENT. WHEN
THE SYSTEM IS RUNNING THE GREEN PILOT LIGHT WILL
BE ILLUMINATED.

(4)

3. VACUUM START / STOP: THIS SET OF PUSH BUTTONS CONTROL THE (ON-OFF) CYCLE OF THE LID VACUUM PUMP. WHEN THE VACUUM PUMP IS RUNNING A GREEN PILOT LIGHT WILL BE ILLUMINATED.

C: SELECTOR SWITCHES

1. AUTO / MANUAL: THIS SELECTOR SWITCH DETERMINES MODE OF OPERATION EITHER MANUAL OR AUTO. IF PLACED IN THE AUTO (NORMAL OPERATING MODE) THE SYSTEM IS CONTROLLED BY THE SYSTEM (START / STOP) PUSH BUTTONS. IF THIS SWITCH IS PLACED IN THE MANUAL MODE THE SYSTEM CAN BE OPERATED OUTSIDE OF THE P.L.C. SUPERVISION. ALL SELECTOR SWITCHES EXCEPT THE RUN/COUNT SELECTOR ON THE RIGHT HAND ENCLOSURE DOOR MUST BE TURNED TO THE RUN POSITION AND THE SYSTEM WILL OPERATE.

D: JOG PUSH BUTTONS:

1. JOG: WITH THE AUTO / MANUAL SELECTOR SWITCH IN THE MANUAL POSITION THE LID ELEVATOR CONVEYOR CAN BE JOGGED UP UNTIL LIDS REACH SWITCH S-35 (LIDS NEEDED).
2. INCH: WITH THE AUTO / MANUAL SELECTOR SWITCH IN THE MANUAL POSITION AND THE SYSTEM START CIRCUIT ENERGIZED, THE YAGUCHI SEAMER CAN BE INCHED. THE SPEED OF THE SEAMER CAN BE CONTROLLED BY THE MANUAL SPEED POT. LOCATED ON THE RIGHT HAND ENCLOSURE DOOR.

(S)

E: FAULT INDICATORS:

1. CAP CONVEYOR: LID NOT IN POSITION AS DETERMINED BY LIMIT SWITCHES LS-8 AND LS-10.
2. TURNING: TURNING WHEEL NOT IN POSITION AS DETERMINED BY LIMIT SWITCH LS-1
3. OVER TORQUE: A OVER TORQUE CONDITION EXISTS AS DETERMINED BY LIMIT SWITCH LS-2.
4. NO COVER / NO BODY: EITHER A TRAY OR LID IS MISSING AT POINT OF MATING AS DETERMINED BY LIMIT SWITCHES LS-4, LS-5 AND LS-7.
5. CARRIER: A CARRIER FAULT HAS OCCURRED AS DETERMINED BY LIMIT SWITCH LS-6.
6. VACUUM: A LOW VACUUM CONDITION EXISTS ON THE SEALER AS DETERMINED BY PS-1 AND LIMIT SWITCH LS-3.
7. REJECT CONVEYOR FULL: REJECT CONVEYOR FULL AS DETERMINED BY PHOTO-EYE (PE-2).
8. DISCHARGE CONVEYOR FULL: DISCHARGE CONVEYOR FULL AS DETERMINED BY PHOTO-EYE (PE-1).
9. PROCESSOR BATTERY LOW: INDICATES THAT THE A/B P.L.C. 5/12 BATTERY SHOULD BE REPLACED. NOTE: SEE ALLEN BRADLEY PUBLICATION 1785-6.6.1 FOR PROPER BATTERY REPLACEMENT PROCEDURE.
10. MOTOR OVERLOAD: A MOTOR OVERLOAD CONDITION EXISTS AS DETERMINED BY MOTOR STARTERS OVERLOAD RELAYS.

(6)

THESE ARE DESIGNATED (OL-1) THRU (OL-9).

F: FAULT CONDITION OVERVIEW:

WHEN A FAULT CONDITION OCCURS THE SYSTEM IS SHUT DOWN AN ALARM SOUNDS AND THE RED BEACON IS ACTIVATED.

AFTER THE FAULT IS CLEARED THE FAULT RESET PUSH BUTTON MUST BE DEPRESSED AND THE SYSTEM THEN CAN BE RESTARTED.

WHEN IN A FAULT CONDITION THE ALARM CAN BE SILENCED BY DEPRESSING THE SYSTEM STOP PUSH BUTTON.

G: AMBER BEACON:

THE AMBER BEACON IS ACTIVATED WHEN THE FOLLOWING CONDITIONS EXISTS

1. REJECT CONVEYOR FULL
2. DISCHARGE CONVEYOR FULL

H: NEAMATRON

ALL FAULT CONDITIONS ARE DISPLAYED AS THEY OCCUR.

J: COUNTER:

WHEN THE SELECTOR SWITCH RUN / COUNT IS IN THE COUNT POSITION THE SYSTEM WILL OPERATE UNTIL THE PRESET OF THE PRODUCTION COUNTER IS REACHED. THE COUNT IS DETERMINED BY PHOTO-EYE (P.E.-1).

(7)

K: RATE MONITOR:

THE RATE MONITOR DISPLAYS THE NUMBER OF TRAYS
PER MINUTE THE SYSTEM IS OPERATING AT.

III. ELECTRONIC LINE SHAFTING

THE SYSTEM IS SYNCHRONIZED BY A FENNER CONTROL
SYSTEM LOCATED ON A SUB PANEL INSIDE THE MAIN
ENCLOSURE. THE SPEED OF THE SYSTEM IS CONTROLLED
BY THIS SYSTEM AND IS NOT A OPERATOR FUNCTION.
FOR FURTHER INFORMATION ON THE FENNER M-TRACK
SYSTEM AND SET UP PROCEDURES REFER TO THE FENNER
PUBLICATIONS PROVIDED.

May 16, 1991

TRAY LINE

STP # 1 - Final Demonstration
CRAMTD Pilot Plant

Attendees: Russ Eggers (DLA), Col. DeBok (DLA), Diane Wood (Natick)
CRAMTD Staff and Faculty.

Run #1

80 trays were automatically filled with water and sealed at 10 trays/min. Approximately 1050 grams of water were filled per tray (typical fill for Peas and Brine MIL-P-44620). 80 trays were filled with water and sealed at 16 trays/min. Trays at beginning, middle and end of each run were selected for seam inspection per Central States Can procedures.

Results: Line had one shutdown due to Lid Dispenser Fault - Out of Lids - chain lift did not complete replenishment cycle before last lid, adjustment of proximity switch will start cycle while more lids are in magazine. Seam inspection will be reported separately.

Run #2

10 trays each at 16 and 20 trays/min. with cubes and starch solution were placed on the conveyor and sealed. Trays were hand filled with rubber cubes (approx. 1870 gms) and starch solution (approx. 1130 gms, viscosity - 1970 cp at room temperature, Brookfield #3 spindle @ 10 rpm). These trays represent typical fill weights for Beef Chunks in Gravy, MIL-B-44230. Several trays were selected for seam inspection.

Results: Tray line ran normally. No slosh was noted. Seam inspection will be reported separately.

Run #3

1 tray at 10, 2 trays at 16 and 2 trays at 20 trays/min. with peas and water were placed on the conveyor and sealed. Trays were hand filled with peas (approx. 2010 gms) and water (approx. 1050 gms), typical of Peas and Mushrooms, MIL-P-44260. Trays were carefully observed for sloshing.

Results: No sloshing at 10 trays/min. At higher speeds sloshing occurred at Seamer Pusher Lug and Vacuum Chamber Stop. Amount of slosh was evaluated in a previous study. Minor slosh (no product lost) was noted at the Seamer Infeed Conveyor. Adjustment of Spacing Conveyor Controller will be made to synchronize transport lug more closely to tray and eliminate the stop/start motion. The first tray at each speed was rejected by the Checkweigher without apparent cause, possibly an error in the Checkweigher or PLC programming, will investigate with Enterprise Electric.

Run #4

Several trays with cubes above rim were run down the conveyor

line to demonstrate optical mound detector feature.

Results: The mounded trays were diverted, acceptable trays continued to seamer.

Run #5

Several underfilled and overfilled trays were run down the line to demonstrate checkweigher functions.

Results: Trays below 104 ounces and above 110 ounces were rejected.

Discussion:

Sloshing is a minor problem, it occurs in the Seamer at 16 trays/min and faster, but only with water. A viscous sauce or gravy does not slosh at these speeds. The military should consider adopting a rationale for acceptable sloshing of brine based on meeting fill weight and seam requirements in view of established commercial practices. Russ Eggers suggested submitting an STP proposal to investigate a shock absorber/motion control mechanism to attempt elimination of the slosh problem.



Interdepartmental Communication

CRAMTD

May 23, 1991

TO: T. Descovich

FROM: S. Cimino

RE: Seam Inspection of Cans Made on 5/16/91

All seam dimensions fall within Central State Can Company double seam guide, dated December, 1990 (sheet specs. attached). All cans inspected will be retained for confirmation.

SC:d

Amie

CENTRAL STATES CAN CO.

DOUBLE SEAM GUIDE

CUSTOMER:

DATE ISSUED: DECEMBER 1990

CONTAINER SIZE: 1/2 Size Tray Steel

BASE WEIGHT: BODY - 90# T-4 tin free steel DWG: #D1061-0002

END - 90# T-4 tin free steel #D2134-0003

NOTE: These dimensional guidelines will be used on 90# plate 1/2 size trays until further data is obtained.

REFERENCE ROLL PROFILE TYPE: 1ST OPERATION

R-37

2ND OPERATION

S-15

	<u>SET-UP</u>	<u>OPERATIONAL</u>
1st Operation seam thickness	.080 ± .005	.080 ± .005
2nd Operation seam thickness	.056 ± .003	.056 ± .005
Finished seam height	.120 ± .005	.120 ± .008
Bodyhook length	.075 ± .005	.075 ± .010
Coverhook length	.062 Oper Min.	Same
Overlap	.035 Oper Min.	Same
Cover tightness rating	90%	70% Min.

NOTE: It is important to note that a true looseness wrinkle has height, depth, and length. Often the profile of an ironed out 1st operation wave with no depth will show. Thus, it should not be misconceived as a looseness wrinkle.

The maintenance of sound double seam integrity is the responsibility of the cannery. Therefore, the proper training of the responsible personnel is an essential factor toward sound judgment. The container supplier offers assistance in training personnel as well as assistance in trouble shooting double seam problems.

The above dimensions are guidelines to assist you in forming a hermetic seal. It is the experience of the industry that a double seam must be judged in its entirety and not by dimensions alone. To do a thorough, meaningful double seam examination, evaluation should be made by a combined visual and micrometer method.

SEAM INSPECTION INTERVALS

Internal seam evaluation should be conducted at start-up and at intervals of every four hours or immediately after a can jam. Visual inspection should be made at intervals of every 30 minutes or immediately after can jam.

COMPANY NAME: Kaitag

DATE: 5/16/71

PRODUCT: TEST (SEAMER) (YAGUCHI)

CHECK TIME:

PRODUCT CODE: 1010 20 pl/min

LA INSPECTOR: S. Q. min

CONTRACT NO.:

SEAMER TYPE: Yaguchi YP-SV

SERIAL NO.: 108

COMMENTS OR SEAM

ADJUSTMENTS:

* Note - Same as previous

Use to process on

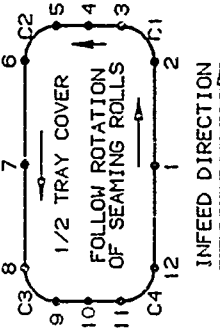
back plate

SEAM QUALITY CONTROL FORM

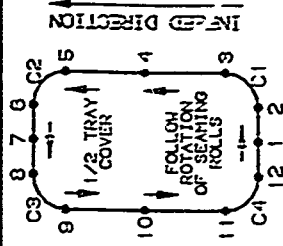
CHECK TIME:	POSITION			1	2	3	4	5	6	7	8	9	10	11	12
PRODUCT CODE: 14510 20/100	THICKNESS			.063	.061	.060	.061	.059	.060	.057	.061	.063	.059	.053	
(A INSPECTOR: S Q, m, n	HEIGHT (WIDTH)			.119	.119	.112	.111	.110	.110	.108	.117	.111	.123	.122	
CONTRACT NO.:	BODY HOOK			.079	.078	.060	.074	.050	.050	.060	.053	.073	.073	.051	
SEAMER TYPE: Yaguchi, YP-SV	COVER HOOK			.071	.071	.060	.077	.055	.055	.079	.060	.079	.077	.073	
SERIAL NO.: 108	OVERLAP			.054	.057	.050	.050	.050	.050	.060	.065	.066	.050	.050	
COMMENTS OR SEAM ADJUSTMENTS:	VISUAL BODY IMPRESSION														
	TIGHTNESS 75-100% (CHINKLE RATING)														
* Note - Some impressions				CORNER 1			CORNER 2			CORNER 3			CORNER 4		

back plate												
						</						

YAGUCHI SEAMER



F.M.C. OR
CALLAHAN
SEAMER &
YAGUCHI
SEMI-AUTOMATIC



COMPANY NAME: Rutgers

DATE: 5/16/91

PRODUCT: Test cubes + starch

CHECK TIME:

PRODUCT CODE: 10010 1/4 in. 2/m

QA INSPECTOR: S. G. Liming

CONTRACT NO.:

SEAMER TYPE: Yaguchi / R-SY

SERIAL NO.: 108

COMMENTS OR SEAM ADJUSTMENTS:

* note: Some low pressure

Due to pressure use in

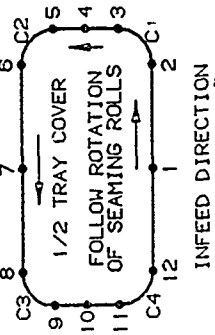
chuck plate

SEAM QUALITY CONTROL FORM

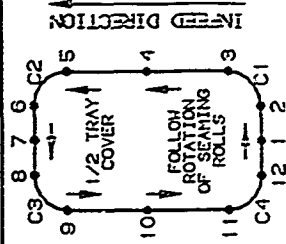
POSITION	1	2	3	4	5	6	7	8	9	10	11	12
THICKNESS	.060	.059	.061	.059	.061	.058	.057	.059	.060	.055	.057	.057
HEIGHT (WIDTH)	.119	.121	.115	.112	.117	.118	.117	.116	.117	.123	.124	.121
BODY HOOK	.084	.076	.069	.074	.084	.083	.076	.083	.077	.078	.083	.0
COVER HOOK	.075	.075	.072	.073	.072	.080	.081	.081	.073	.080	.084	.077
OVERLAP	.053	.051	.052	.057	.058	.061	.057	.063	.059	.056	.062	.05
VISUAL BODY IMPRESSION	✓											
TIGHTNESS 75-100% (WRINKLE RATINGS)	100	No Wrinkles		100	No Wrinkles		100	No Wrinkles		100	No Wrinkles	
CORNER 1			CORNER 2			CORNER 3			CORNER 4			

POSITION	1	2	3	4	5	6	7	8	9	10	11	12
THICKNESS												
HEIGHT (WIDTH)												
BODY HOOK												
COVER HOOK												
OVERLAP												
VISUAL BODY IMPRESSION												
TIGHTNESS 75-100% (WRINKLE RATINGS)												
CORNER 1			CORNER 2			CORNER 3			CORNER 4			

YAGUCHI SEAMER



F.M.C. OR
CALLAHAN
SEAMER &
YAGUCHI
SEMI-AUTOMATIC



DATE: 5/16/91

PRODUCT: Test (water)

CHECK TIME:

PRODUCT CODE: #1 16 can 9/14

QA INSPECTOR: S. Cipriano

CONTRACT NO.:

SEAMER TYPE: Yaguchi YR-SV

SERIAL NO.: 108

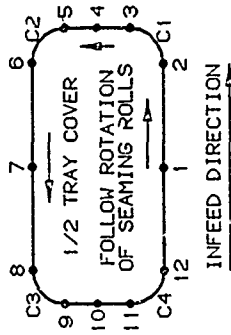
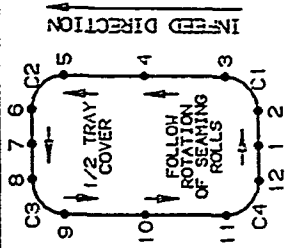
COMMENTS OR SEAM
ADJUSTMENTS:Note Some impressionsDue to impressions onchuck plate

SEAM QUALITY CONTROL FORM

POSITION	1	2	3	4	5	6	7	8	9	10	11	12
THICKNESS	.053	.054	.063	.059	.061	.060	.055	.060	.059	.060	.054	.051
HEIGHT (WIDTH)	.119	.120	.115	.114	.118	.117	.115	.117	.116	.120	.122	.117
BODY HOOK	.077	.079	.066	.074	.079	.079	.078	.081	.075	.075	.076	.081
COVER HOOK	.078	.082	.069	.073	.073	.081	.072	.077	.075	.076	.075	.071
OVERLAP	.060	.063	.052	.056	.055	.061	.058	.061	.048	.048	.048	.055
VISUAL BODY IMPRESSION	✱											✱
TIGHTNESS 75-100% (CRINKLE RATINGS)	100	No Wrinkles	100	No Wrinkles	No Wrinkles	100	100	No Wrinkles	100	100	No Wrinkles	CORNER 4
	CORNER 1			CORNER 2			CORNER 3			CORNER 4		

POSITION	1	2	3	4	5	6	7	8	9	10	11	12
THICKNESS												
HEIGHT (WIDTH)												
BODY HOOK												
COVER HOOK												
OVERLAP												
VISUAL BODY IMPRESSION												
TIGHTNESS 75-100% (CRINKLE RATINGS)												
	CORNER 1			CORNER 2			CORNER 3			CORNER 4		

YAGUCHI SEAMER

F.M.C. OR
CALLAHAN
SEAMER &
YAGUCHI
SEMI-AUTOMATIC

COMPANY NAME: Raifort

DATE: 5/16/91

PRODUCT: TEST

CHECK TIME:

PRODUCT CODE: 1045 16/min

QA INSPECTOR: S. Cimino

CONTRACT NO.:

SEAMER TYPE: Yaguchi YR-SV

SERIAL NO.: 108

COMMENTS OR SEAM
ADJUSTMENTS:

* Note: Some dimensions

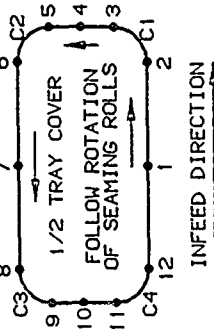
Ducta impressions at
chuck plate

SEAM QUALITY CONTROL FORM

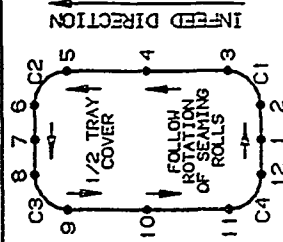
POSITION	1	2	3	4	5	6	7	8	9	10	11	12
THICKNESS	.056	.055	.061	.060	.060	.061	.059	.061	.061	.057	.060	.055
HEIGHT (WIDTH)	.121	.127	.118	.113	.116	.117	.116	.118	.117	.121	.126	.118
BODY HOOK	.077	.079	.067	.072	.081	.081	.082	.085	.079	.077	.082	.071
COVER HOOK	.075	.071	.070	.071	.075	.078	.074	.079	.074	.075	.071	.071
OVERLAP	.057	.042	.051	.055	.055	.062	.052	.062	.052	.052	.051	.054
VISUAL BODY IMPRESSION	* <											
TIGHTNESS 75-100% (WRINKLE RATING)	100			100			100					
	CORNER 1			CORNER 2			CORNER 3			CORNER 4		

POSITION	1	2	3	4	5	6	7	8	9	10	11	12
THICKNESS												
HEIGHT (WIDTH)												
BODY HOOK												
COVER HOOK												
OVERLAP												
VISUAL BODY IMPRESSION												
TIGHTNESS 75-100% (WRINKLE RATING)												
	CORNER 1			CORNER 2			CORNER 3			CORNER 4		

YAGUCHI SEAMER



F.M.C. OR
CALLAHAN
SEAMER &
YAGUCHI
SEMI-AUTOMATIC



COMPANY NAME: Yaguchi

DATE: 5/16/91

PRODUCT: Tray (water)

CHECK TIME:

PRODUCT CODE: 80 16 can pln

QA INSPECTOR: S. C. minor

CONTRACT NO.:

SEAMER TYPE: Yaguchi YR-SV

SERIAL NO.: 108

COMMENTS OR SEAM ADJUSTMENTS:

Note: Some impressions

Due to impression on

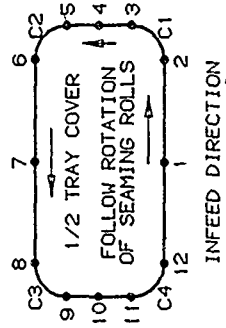
chuck plate

SEAM QUALITY CONTROL FORM

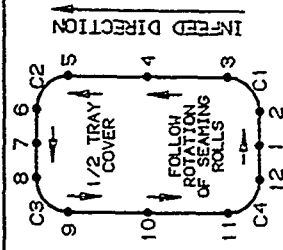
POSITION	1	2	3	4	5	6	7	8	9	10	11	12
THICKNESS	.057	.056	.061	.060	.059	.058	.056	.060	.061	.057	.057	.055
HEIGHT (WIDTH)	.125	.122	.113	.115	.116	.118	.117	.120	.119	.122	.123	.118
BODY HOOK	.081	.075	.070	.074	.081	.082	.081	.084	.077	.076	.081	.081
COVER HOOK	.080	.077	.071	.074	.074	.081	.076	.080	.078	.079	.080	.077
OVERLAP	.052	.054	.050	.053	.054	.062	.056	.060	.056	.053	.058	.052
VISUAL BODY IMPRESSION	*	---	---	---	---	---	---	---	---	---	---	---
TIGHTNESS 75-100% (CRINKLE RATING)	100	No wrinkles	100	100	No wrinkles	100	100	No wrinkles	100	No wrinkles	100	No wrinkles
CORNER 1			CORNER 2			CORNER 3			CORNER 4			

POSITION	1	2	3	4	5	6	7	8	9	10	11	12
THICKNESS												
HEIGHT (WIDTH)												
BODY HOOK												
COVER HOOK												
OVERLAP												
VISUAL BODY IMPRESSION												
TIGHTNESS 75-100% (CRINKLE RATING)												
CORNER 1			CORNER 2			CORNER 3			CORNER 4			

YAGUCHI SEAMER



F.M.C. OR
CALLAHAN
SEAMER &
YAGUCHI
SEMI-AUTOMATIC



COMPANY NAME: RUTGERS

DATE: 5/16/91

PRODUCT: TEST (water)

CHECK TIME:

PRODUCT CODE: CAN 10/min

QA INSPECTOR: SCM

CONTRACT NO.:

SEAMER TYPE: YAGUCHI YR

SERIAL NO.: 108

COMMENTS OR SEAM

ADJUSTMENTS:

Can #1 at 10

caps per minute

* Note some impressions

Due to impression on

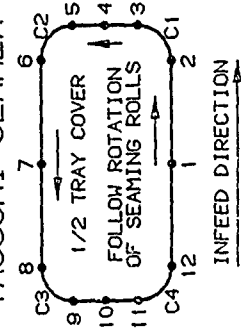
chuck plate

SEAM QUALITY CONTROL FORM

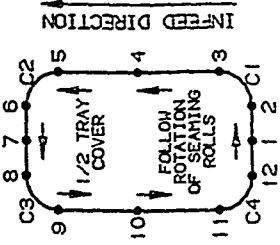
POSITION	1	2	3	4	5	6	7	8	9	10	11	12
THICKNESS	.061	.059	.057	.041	.060	.059	.059	.061	.061	.058	.058	.06
HEIGHT (WIDTH)	.121	.117	.117	.115	.120	.119	.120	.117	.115	.116	.121	.116
BODY HOOK	.081	.081	.071	.082	.085	.083	.084	.085	.073	.076	.083	.08
COVER HOOK	.077	.075	.081	.078	.075	.083	.079	.081	.076	.078	.077	.071
OVERLAP	.065	.053	.049	.060	.059	.064	.061	.064	.052	.055	.054	.06
VISUAL BODY IMPRESSION	*	---	---	---	---	---	---	---	---	---	---	*
TIGHTNESS 75-100% (WRINKLE RATING)	100	NO WRINKLES	---	100	NO WRINKLES	---	100	NO WRINKLES	---	---	---	WRINKLES
CORNER 1			CORNER 2			CORNER 3			CORNER 4			

POSITION	1	2	3	4	5	6	7	8	9	10	11	12
THICKNESS												
HEIGHT (WIDTH)												
BODY HOOK												
COVER HOOK												
OVERLAP												
VISUAL BODY IMPRESSION												
TIGHTNESS 75-100% (WRINKLE RATING)												
CORNER 1			CORNER 2			CORNER 3			CORNER 4			

YAGUCHI SEAMER



F.M.C. OR
CALLAHAN
SEAMER &
YAGUCHI
SEMI-AUTOMATIC



COMPANY NAME: Rutgers

DATE: 5/16/91

PRODUCT: Test

CHECK TIME:

PRODUCT CODE: 30 #50 10/min

QA INSPECTOR: S. Cimino

CONTRACT NO.:

SEAMER TYPE: Yaguchi YR-SV

SERIAL NO.: 108

COMMENTS OR SEAM ADJUSTMENTS:

* Note - Some impressions

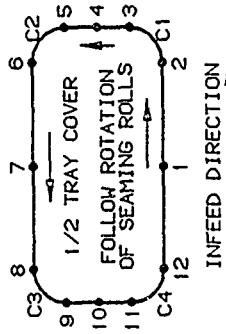
Due to impressions on
chuck plate

SEAM QUALITY CONTROL FORM

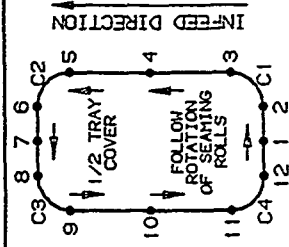
POSITION	1	2	3	4	5	6	7	8	9	10	11	12
THICKNESS	.054	.059	.059	.059	.060	.059	.059	.060	.061	.057	.058	.057
HEIGHT (WIDTH)	.117	.119	.117	.113	.116	.118	.116	.118	.119	.120	.122	.121
BODY HOOK	.070	.079	.070	.072	.081	.081	.079	.081	.072	.075	.081	.077
COVER HOOK	.080	.081	.082	.076	.072	.080	.077	.079	.075	.080	.075	.081
OVERLAP	.062	.060	.054	.056	.053	.060	.060	.061	.050	.053	.054	.053
VISUAL BODY IMPRESSION	*4											*
TIGHTNESS 75-100% (CRINKLE RATING)	100	No Brn & Lg		100	No Brn & Lg		100	No Brn & Lg		100	No Brn & Lg	
CORNER 1			CORNER 2			CORNER 3			CORNER 4			

POSITION	1	2	3	4	5	6	7	8	9	10	11	12
THICKNESS												
HEIGHT (WIDTH)												
BODY HOOK												
COVER HOOK												
OVERLAP												
VISUAL BODY IMPRESSION												
TIGHTNESS 75-100% (CRINKLE RATING)												
CORNER 1			CORNER 2			CORNER 3			CORNER 4			

YAGUCHI SEAMER



F.M.C. OR
CALLAHAN
SEAMER &
YAGUCHI
SEMI-AUTOMATIC



COMPANY NAME: Rutgers

DATE: 5/16/91

PRODUCT: Test

CHECK TIME:

PRODUCT CODE: can #67 10/min

QA INSPECTOR: S. C. mino

CONTRACT NO.:

SEAMER TYPE: Yaguchi YP-SV

SERIAL NO.: 108

COMMENTS OR SEAM ADJUSTMENTS:

* Note: Some impressions

Due to impressions

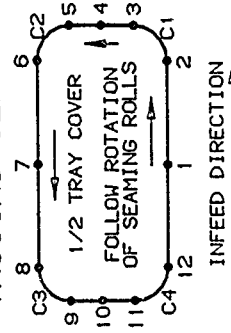
on chuck plate

SEAM QUALITY CONTROL FORM

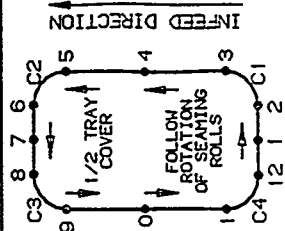
POSITION	1	2	3	4	5	6	7	8	9	10	11	12
THICKNESS	.057	.059	.060	.059	.062	.061	.056	.062	.061	.060	.058	.05
HEIGHT (WIDTH)	.115	.121	.117	.116	.115	.116	.114	.117	.115	.118	.124	.111
BODY HOOK	.078	.079	.068	.072	.079	.080	.082	.081	.073	.075	.080	.074
COVER HOOK	.081	.081	.079	.076	.075	.081	.072	.080	.077	.078	.078	.075
OVERLAP	.062	.060	.047	.057	.057	.063	.069	.061	.051	.051	.052	.051
VISUAL BODY IMPRESSION	*											*
TIGHTNESS 75-100% (CRINKLE RATING)	100	No burr in toes			100	No burr in toes			No burr in toes			CORNER 4
		CORNER 1				CORNER 2			CORNER 3			

POSITION	1	2	3	4	5	6	7	8	9	10	11	12
THICKNESS												
HEIGHT (WIDTH)												
BODY HOOK												
COVER HOOK												
OVERLAP												
VISUAL BODY IMPRESSION												
TIGHTNESS 75-100% (CRINKLE RATING)												
		CORNER 1				CORNER 2			CORNER 3			CORNER 4

YAGUCHI SEAMER



F.M.C. OR
CALLAHAN
SEAMER &
YAGUCHI
SEMI-AUTOMATIC



CRAMTD STP-1 Traycan Sloshing Report

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I. Objectives

Examine the extent of sloshing during the conveying and sealing processes in the traycan line, as a function of machine output speed and the rheological properties of the food.

II. Introduction

Sloshing of food is defined here as the undesired movement of the liquid portion of the food in an open container being conveyed or transported through a packaging line. Severe sloshing results in splashing or spilling of food outside the container and possible contamination of the seal area with solid food particles. The last does not, necessary, adversely affecting the seal integrity.

External factors that affect sloshing are acceleration or deacceleration in the linear motion of the container, angular acceleration, non smooth transitions between different conveying systems and packaging stations, and also packaging design such as total volume, lateral angles and orientation of the container

Internal factors that affect sloshing are the viscosity of the liquid portion as well as the amount and shape of the solid portion of the food.

II. Results and Discussion

During the test run on April 24-25, 1991, a series of traycans containing starch solutions at different viscosities with or without rubber cubes, simulating beef chunks, were visually examined for sloshing on the traycan line at the CRAMTD facility.

Sloshing was examined at seven transition zones along the traycan line at four traycan production speeds.

Tables 1 through 4 show the results from the experiment on sloshing, at 5, 10, 16 and 20 trays/min respectively.

In the traycan conveyor section sloshing is limited and occurs only when water is used. Even then there is no sloshing out of the tray. A potential problem may arise at the seamer section, operating at 16 trays/min or higher speed for traycans containing liquids with approximately viscosities less than 1000 cp.

Attachment in this report is a video tape containing a synopsis of the experiment on sloshing.

Table 1. Results⁽¹⁾ at 5 trays/min line speed⁽²⁾

	Filling conveyor	Checkwei gher	Phasing Conveyor	Reject Conveyor	Seamer Infeed	Seamer Entrance	Seamer Exit
2440 cp	none	none	-	-	-	-	-
970 cp	none	none	-	-	-	-	-
water	slight	none	-	-	-	-	-
2440 cp	none	none	-	-	-	-	-
w/o cubes							
970 cp	none	none	-	-	-	-	-
w/o cubes							
Water	moderate	none	-	-	-	-	-
w/o cubes							

(1) slight: 0.25" slosh; moderate: 0.35" slosh; large: 0.5" slosh; very large: liquid sloshed out of tray.

(2) From April 24-25, 1991 experiment on sloshing

Table 2. Results⁽¹⁾ at 10 trays/min line speed⁽²⁾

	Filling conveyor	Checkwei gher	Phasing Conveyor	Reject Conveyor	Seamer Infeed	Seamer Entrance	Seamer Exit
2440 cp	none	none	-	-	-	-	-
970 cp	none	none	-	-	-	-	-
water	moderate	none	-	-	-	-	-
2440 cp	none	none	-	-	-	-	-
w/o cubes							
970 cp	slight	none	-	-	-	-	-
w/o cubes							
Water	large	slight	-	-	-	-	-
w/o cubes							

(1) slight: 0.25" slosh; moderate: 0.35" slosh; large: 0.5" slosh; very large: liquid sloshed out of tray.

(2) From April 24-25, 1991 experiment on sloshing

Table 3. Results⁽¹⁾ at 16 trays/min line speed⁽²⁾

	Filling conveyor	Checkweigher	Phasing Conveyor	Reject Conveyor	Seamer Infeed	Seamer Entrance	Seamer Exit
2440 cp	slight	none	-	-	-	none	none
970 cp	slight	none	none	moderate	slight	very large	none
water	large)	none	slight	moderate	moderate	-	very large
2440 cp	none	none	-	-	-	-	-
w/o cubes							
970 cp	moderate	none	-	-	-	-	-
w/o cubes							
Water	large	slight	-	-	-	-	-
w/o cubes							

(1) slight: 0.25" slosh; moderate: 0.35" slosh; large: 0.5" slosh; very large: liquid sloshed out of tray.

(2) From April 24-25, 1991 experiment on sloshing

Table 4. Results⁽¹⁾ at 20 trays/min line speed⁽²⁾

	Filling conveyor	Checkweigher	Phasing Conveyor	Reject Conveyor	Seamer Infeed	Seamer Entrance	Seamer Exit
2440 cp	none	none	-	-	-	none	none
970 cp	none	none	none	none	moderate	very large	large
water	moderate	moderate	none	moderate	large	-	-
2440 cp	moderate	none	-	-	-	-	-
w/o cubes							
970 cp	moderate	none	-	-	-	-	-
w/o cubes							
Water	large	slight	-	-	-	-	-
w/o cubes							

(1) slight: 0.25" slosh; moderate: 0.35" slosh; large: 0.5" slosh; very large: liquid sloshed out of tray.

(2) From April 24-25, 1991 experiment on sloshing

Tray Line Demonstration

Video Tape Documentation

Date Taped: April 24-25, 1991

Place Taped: Rutgers, Food Science Building, CRAMTD Pilot Plant

VCR	Liquid		
Tape	Viscosity		
(Min.)	(Cp.)	Slosh	Notes

Test Set Up, Preparing Trays
00.00

Test Set Up, Viscometer, Viscosity Measurements
00.86

Tray Pack Line Operating
02.30

Filling Conveyor @ 5 trays/min.

02.79	2440	None	
03.92	970	None	
04.96	Water	Slight	.25" slosh
06.26	2440 w/o cubes	None	
	970 w/o cubes	None	
	Water w/o cubes	Mod.	.375" slosh

Filling Conveyor @ 10 trays/min.

06.95	2440	None	
07.68	970	None	
08.13	Water	Mod.	.375" slosh
08.80	2440 w/o cubes	None	
	970 w/o cubes	Slight	
	Water w/o cubes	Large	.5" slosh

Filling Conveyor @ 16 trays/min.

09.38	2440	Slight	
09.99	970	Slight	
10.57	Water	Mod.	.5" slosh
11.15	2440 w/o cubes	None	
	970 w/o cubes	Mod.	
	Water w/o cubes	Mod.	.5" slosh

Filling Conveyor @ 20 trays/min.

11.56	2440	None	
12.10	970	None	
12.71	Water	Mod.	.25" slosh
13.24	2440 w/o cubes	Mod.	
	970 w/o cubes	Mod.	
	Water w/o cubes	Large	.5" slosh

Checkweigher @ 5 trays/min.

13.82	2440	None
14.60	970	None
15.63	Water	None
16.55	2440 w/o cubes	None
	970 w/o cubes	None
	Water w/o cubes	None

Checkweigher @ 10 trays/min.

17.38	2440	None
17.81	970	None
18.30	Water	None
18.78	2440 w/o cubes	None
	970 w/o cubes	None
	Water w/o cubes	Mod. .25" slosh

Checkweigher @ 16 trays/min.

19.27	2440	None
19.61	970	None
19.95	Water	None
20.27	2440 w/o cubes	None
	970 w/o cubes	None
	Water w/o Cubes	Slight

Checkweigher @ 20 trays/min.

20.55	2440	None
20.84	970	None
21.17	Water	Mod. .25" slosh
21.45	2440 w/o cubes	Negligible
	970 w/o cubes	Negligible
	Water w/o cubes	Negligible

Mound Detector Demonstration @ 16 trays/min.

21.80	Cube placed above rim, tray rejected and diverted to left lane
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Checkweigher Test @ 16 trays/min. - Within Specified Weight Range
 22.03 Actual tray weight 108.6 oz.,
 tray continues on line to seamer

Checkweigher Test @ 16 trays/min. - Underweight Tray
 22.27 Actual tray weight 103.2 oz.,
 tray rejected (104 oz. min.),
 note red reject light on top of
 checkweigher cabinet

Reject Diverter @ 16 trays/min.

22.49	970	None	Smooth transfer to Phasing Conveyor
	970	Mod.	Reject Conveyor start-up slow, move optical sensor toward diverter
22.76	Water	Mod.	Transfer to Phasing Conveyor and Reject Conveyor - .25" slosh

Reject Diverter @ 20 trays/min.

23.16	970	None	Smooth transfer to Phasing and Reject Conveyors
23.33	Water	None	Smooth transfer to Phasing Conveyor
	Water	Mod.	Late start-up of Reject Conveyor

Seamer Infeed Conveyor @ 16 trays/min.

23.59	970	Negligible	
23.95	Water	Slight	Slosh at transfer to chain
		Large	Slosh at abrupt stop when tray falls off chain transport
		Mod.	Slosh when transport lug hits tray

Seamer Infeed Conveyor @ 20 trays/min.

24.32	970	Mod.	Slosh when tray falls off chain
24.65	Water	Mod.	Slosh at transfer to chain due to uneven chain motion
		V.Lrg.	Slosh when tray falls off chain
		Large	Slosh when transport lug hits tray

Seamer Entrance @ 16 trays/min.

24.90	970	V.Lrg.	Uneven motion of Lifting Transport Lug, second tray sloshed liquid out of tray
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Seamer Entrance @ 20 trays/min.

25.47	970	V.Lrg.	Liquid sloshed out of tray
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Seamer Entrance @ 16 trays/min.

25.82	2440	None	
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Seamer Entrance @ 20 trays/min.

26.06	2440	None	
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Seamer Exit @ 16 trays/min.

26.21	2440	None	
26.67	970	None	
27.16	Water	V.Lrg.	Liquid sloshed out of tray hitting stop lug in vacuum chamber

Seamer Exit @ 20 trays/min.

27.40	2440	None	
27.47	970	Large	Evidence of slosh on exterior of can

CRAMTD

May 15, 1991

To: Files

From: Neal Litman

Subject: Investigation of Slosh on Tray Pack Line

An experiment was performed to quantify sloshing of 1/2 Steam Table Tray. The test was made on May 8th, 1991.

Background:

Liquid sloshing was noted at the seamer in the Tray Line Video Tape Demonstration, April 24-25. Sloshing was observed at high production speeds (at 16 trays per minute and above) and with trays filled with liquids of low viscosity. This follow-up test was made to measure what condition and to what degree sloshing occurs.

Procedure:

6 trays were prepared with rubber blocks and water/starch solution, to simulate Beef Chunks and Gravy, MIL-B-44230B. 6 trays were prepared with pens and water, simulating MIL-P-44260. Fill weights were in accordance with military specifications. Accurate weights were recorded for each tray can, lid and contents. Trays were run on the line at rates of 16 and 20 trays per minute and observed visually for sloshing prior to reaching the seamer. After seaming, trays were weighed and weight loss determined by calculation. Losses were reported as a percentage of the liquid fill weight.

Results:

See attached for test measurements and results.

Conclusions:

Viscous starch solutions produce negligible sloshing and will not create any problem for this production line. Lower viscosities (water) will slosh a minor amount at high line speed. There was no loss of gravy at speeds up to 20 trays per minute and only a small loss of water. Since the measured loss for all cans is well within the accuracy of current filling methods, cans will easily meet product specification for net weight. Inspection of sealed cans showed no leaks and complete seams (no defects).

May 8, 1991

Seamer Sloss Test

Purpose: To investigate quantity of liquid sloshing out of tray at higher line speeds with several different food products. Simulate the following food products; Beef Chunks in Gravy MIL-B-44230B and Peas and Mushrooms MIL-P-44260.

Procedure:		<u>Approx. Fill Wt.</u>
Fill trays:	Rubber blocks	66 oz. (1870 gm.)
	Starch Solution	<u>40 oz. (1130 gm.)</u>
	(~3000cp)	106 3000
	OR	
	Frozen Peas	71 oz. (2010 gm.)
	Water	<u>37 oz. (1050 gm.)</u>
		108 3060

Measure and record accurate weights for each component. Run Tray Nos. 1-3 and 7-9 at 16 trays/min. and Tray Nos. 4-6 and 10-12 at 20 trays/min. Towel dry exterior of trays of any sloshed liquid, record accurate weight measurements. Calculate weight loss.

<u>Tray#</u>	<u>Contents</u>	<u>Tray Wt</u>	<u>Lid</u>	<u>Contents</u>	<u>Liquid</u>	<u>Total</u>	After <u>Seaming</u>
1	Blocks & Starch	244.4	173.9	1864.6	1128.1	3411.0	3409.3
2	Blocks & Starch	244.3	175.1	1869.1	1133.6	3422.6	3420.9
3	Blocks & Starch	245.2	175.1	1859.3	1132.2	3411.8	3410.7
4	Blocks & Starch	241.3	175.4	1860.7	1131.6	3409.2	3406.3
5	Blocks & Starch	244.2	175.3	1881.4	1135.3	3436.2	3434.6
6	Blocks & Starch	245.7	172.9	1880.3	1132.4	3431.3	3429.6
7	Peas & Water	243.4	175.3	2011.4	1053.0	3483.1	3465.7
8	Peas & Water	244.9	174.6	2011.0	1050.6	3481.1	3469.0
9	Peas & Water	244.9	173.3	2010.6	1052.0	3481.3	3469.5
10	Peas & Water	246.4	173.7	2011.9	1053.0	3485.0	3457.3
11	Peas & Water	244.0	172.5	2003.2	1051.2	3477.7	3451.1
12	Peas & Water	244.2	171.7	2011.0	1043.3	3476.7	3464.4

Measure Starch solution viscosity: 3450 cp, Brookfield #3 @10RPM

May 8, 1991

Slosh Test Results

<u>Tray #</u>	<u>Initial Tray</u> <u>Wt. (Gm.)</u>	<u>After</u> <u>Seaming</u> <u>Wt. (Gm.)</u>	<u>Wt.</u> <u>Loss (Gm.)</u>	<u>% Loss</u> <u>Liquid</u>
Blocks and Starch Sol. (3480 cp) @ 16 trays/min.				
1	3411.0	3409.7	1.3	negl.
2	3422.6	3420.9	1.7	negl.
3	3411.8	3410.3	1.5	negl.
Blocks and Starch Sol. (3480 cp) @ 20 trays/min.				
4	3409.2	3406.3	2.9	0.26%
5	3436.2	3434.6	1.6	negl.
6	3431.3	3429.6	1.7	negl.
Peas and Water @ 16 trays/min.				
7	3483.1	3465.7	17.4	1.65%
8	3481.1	3469.0	12.1	1.15%
9	3481.3	3469.5	11.8	1.12%
Peas and Water @ 20 trays/min.				
10	3485.0	3457.3	27.7	2.63%
11	3477.1	3456.0	21.1	2.01%
12	3476.7	3464.7	12.1	1.15%